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Observations on the growth, fruiting and longevity of Furcellaria fastigiata (L.) Lam.

by

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Introduction

Apart from the bearing of fruiting bodies in the form of swollen terminal ramuli, the appearance of *Furcellaria fastigiata* and its incidence in natural populations changes little throughout the year. The species does not show the obvious alternation of growth and defoliation exhibited by such perennial algae as *Gracilaria verrucosa* [2]) (Jones, 1958), *Laminaria saccharina* (Parke, 1948), *Ascophyllum nodosum* (David, 1943), *Rhodomela confervoides*, *Polysiphonia elongata*, and others which also show seasonal changes in appearance. *G. verrucosa* is one of the few red algae upon which growth studies have been made (Causey et al, 1946; Jones, 1958), although quantitative work upon the productivity of standing crops of *Gigartina stellata* and *Chondrus crispus* was carried out by Marshall, Newton & Orr (1949). Amongst the brown algae the growth and longevity of species of *Laminaria* (Fallis, 1916; Parke, 1948), *Fucus* (Knight & Parke, 1950) and some of the American kelps (Fallis, 1915; Hurd, 1916) have been studied. Furthermore, Klugh & Martin (1927) made an investigation of the growth of one green and three brown algae at different depths, using increase in length as a criterion of growth. Their method of measuring plants suspended in the sea was claimed to be unique at the time, but since then observations on

[1]) The observational work reported in this paper was carried out at the Department of Botany, Aberystwyth.

[2]) Unless otherwise indicated, the nomenclature of algal species follows the Preliminary Check List of British Marine Algae (Parke, 1953).

plants growing on concrete blocks in natural conditions have been made (LUND, 1932).

F. fastigiata yields an agar of good quality (DANISH FOREIGN OFFICE JOURNAL, 1950; LUND & BJERRE-PETERSEN, 1952) and, as in the case of the agar weeds *Gigartina stellata* and *Chondrus crispus*, the elucidation of the annual growth rate and seasonal fluctuation in growth is therefore important and has been undertaken as part of an autecological study of the species.

METHODS

The problem of making regular and frequent quantitative observations upon growth in seaweeds is not only one of the inaccessibility of plants which often grow low in the intertidal zone, but also one of measuring the dimensions, *in situ*, of plants of predominantly foliaceous and diffuse habit.

Of the species already investigated *Scytosiphon* (KLUGH & MARTIN, 1927), *Laminaria saccharina* (PARKE, 1948) and to a lesser extent *Ascophyllum nodosum* (DAVID, 1943) have a form in which increase in length of the frond is a more or less satisfactory measurement of growth. It would appear that such species as *Chorda filum*, *Himanthalia elongata*, *Alaria esculenta*, and possibly small forms such as *Asperococcus*, *Chaetomorpha*, *Bangia* and even *Acrochaetium* and *Rhodochorton* would lend themselves to the same method of growth measurement. However, growth in many of these forms is basipetal and apical defoliation of old tissues greatly complicates the picture.

Increase in length would be entirely satisfactory, as a measure of growth, only in a species with an unbranched frond [1]) of uniform cross section with apical growth and without terminal defoliation. Such a form does not exist in macroscopic algae but if, instead of being unbranched, the fronds be regularly dichotomous the form is as close to the ideal as can be found. A comparatively small number of British species have these characteristics and include *Furcellaria fastigiata*, *Bifurcaria rotunda*, *Scinaia furcellata*, *Codium tormentosum*, *Polyides rotundus* (HUDS.) GREV., *Gymnogongrus griffithsae* and possibly *Dictyota dichotoma*. Of these *Furcellaria* has the most uniformly terete and dichotomous frond.

It is realised that increase in length of such a frond is only valid as an *index* of growth and is most satisfactory when dealing with a

[1]) Throughout this account the terms frond or axis refer to the erect dichotomising structure arising from one point on the basal stolon-hapteron system. Except in the sporeling state numerous such fronds or axes normally arise from a ramified stolon-hapteron and this assemblage is termed a plant or plant clump.

single homogenous population of plants. The frequency of dichotomy may vary from place to place (c.f. Knight & Parke, 1950) and it is clear that if a plant branches frequently it may remain quite short despite addition of considerable substance by lateral extension; on the other hand, a frond which rarely branches manifests more of its total growth as increase in length. Since in the present investigation plants from one locality only were measured, discrepancies due to differences in the degree of branching or 'bushiness' are less likely to occur.

The frond of *F. fastigiata* grows in length by the division of the apical cells of the some 100 to 200 axial filaments, which make up the multiaxial centre of the frond (Oltmanns, 1922). The segmentation of the apical cell of each filament is unequal producing a larger erect limb of unlimited growth, which elongates and repeats the process, and a smaller limb which constitutes a lateral filament of limited growth. These lateral filaments are of equal length and their closely packed 'fountain' arrangement around the central axial filaments results in a stout terete frond of uniform thickness and of cartilaginous consistency. The habit of the plant is erect and the branching perfectly dichotomous in uninjured specimens. The dichotomy, however, is not true dichotomy but is effected by a bifurcation of the group of axial filaments into two equal and divergent groups probably by more rapid growth of the outer filaments and/or by an arresting of the growth of the centremost filaments.

The species usually occurs in scattered tufts (Plate Ia, b) a distribution which prevents the determination of the growth by a weight/area method as employed with *Chondrus* and *Gigartina* (Marshall, Newton & Orr, 1949). Although the weight of the thallus might be slightly more accurate as an index of growth, measurement of the external dimensions has the advantage of leaving the plants growing in their natural environment. Klugh & Martin (1927) claimed to observe growth *in situ*, despite the fact that their plants were removed from the shore and suspended on lines in the sea, an arrangement somewhat similar to that employed by Jones (1958) on *G. verrucosa* and now on *Griffithsia* (unpublished).

It was necessary to find a reasonably large population of *F. fastigiata* at such a level on the shore that the plants could be measured at each fortnightly spring tide irrespective of weather conditions. In Cardigan Bay communities including *F. fastigiata* occur at Llanrhysted, Allt Wen, Borth and Aberystwyth. At the first three localities the plants grew on the seaward edge of exposed or semi-exposed rock and boulder shores and were found to be unapproachable in rough weather even at low water extreme spring tides. However, a considerable population of *F. fastigiata* exists at Aberystwyth in a

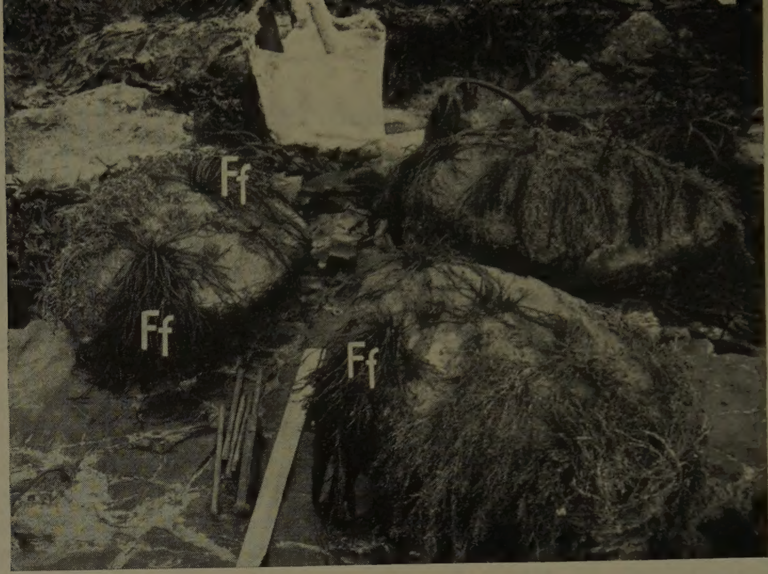

Plate I

a. Plants of *F. fastigiata* (Ff) growing upon boulders from Pwll Padarn at Aberystwyth. The boulders have been taken out of the water momentarily to enable a photograph to be taken. The iron pegs used to mark the permanent quadrats can be seen in the centre foreground.

b. Young plants of *F. fastigiata* (Ff) growing on large stones and boulders in Pwll Padarn. The increase in length of these plants could be recorded by measuring the fronds beneath the surface of the water during most months of the year, but the stones were lifted out of the pool for this purpose during very cold weather.

large lower littoral lagoon sheltered from fierce wave action by a system of off-shore reefs and thus accessible at spring tides even in a gale. The plants were growing on stones and boulders (Plate Ia, b) which were large enough to remain undisturbed by storms throughout the period of observation, which extended over two years.

Various methods were used to enable individual specimens to be easily identified in the constantly submerged and changing community in the lagoon. Attempts were made to isolate plants for study by fixing them, by means of nylon thread, in perforated transparent plastic containers which were fastened to steel pegs driven into rocks low on the shore. This method proved unsuccessful in most cases due to the entanglement and subsequent putrifaction of floating debris in the containers. Plant-tufts *in situ* were marked with (a) plastic chicken rings, (b) coloured nylon thread, (c) coloured ribbons and (d) by means of 9″ lengths of 1/4″ diameter steel rod driven into holes drilled in the boulders with a rawlplug drill (Plate Ia). Only the last method of marking proved successful over long periods. The boulders chosen were of a size suitable for lifting out of, and replacing in, the water so that the plants could be measured when winter conditions made it impossible to measure the fronds accurately under the surface of the water. It was, as it happened, correctly estimated that a boulder just heavy enough to be lifted (i.e. 15 to 20 lbs.) would not, in this locality, be disturbed by wave action.

The length of each erect axis or frond, from the basal stolon, of selected *Furcellaria* plants was measured every fortnight at the lowest spring tide.

When the apex of a frond was lost by injury or by the shedding of a fertile ramulus, this event was recorded, but measurement continued in order to ascertain whether the region below the apex maintained growth in length in the absence of the apical meristem. The period of time which elapsed before the production of a new apex upon a damaged ramulus was also noted.

The loss of fronds as a result of storms and other accidents was unavoidable and this reduced the number which was measured over the total length of the experiment. However, while some were lost in this way, young axes arising from the basal stolon system were included from time to time as soon as they were about 3.0 mms. in length and could be measured with reasonable accuracy.

In addition, some observations and measurements have been made in the laboratory both on entire plants, and plants variously damaged and decapitated, growing in running sea water.

RESULTS

A large number of plants was measured over a period of almost three years, but only one year's uninterrupted readings were possible and are included here.

For practical reasons the measurements had to be carried out on plants growing in a habitat where they do not reach the maximum size attained in other habitats in the region. However, although the values for total growth and for growth rate may be rather low, the results may be expected to give a valid indication of changes in growth rate throughout the year.

It has been impossible to record, individually, the growth of male, female and tetrasporic plants, for without making counts of their chromosomes it is impossible to distinguish these three thalli until they bear fertile ramuli, by which time they have virtually ceased growth.

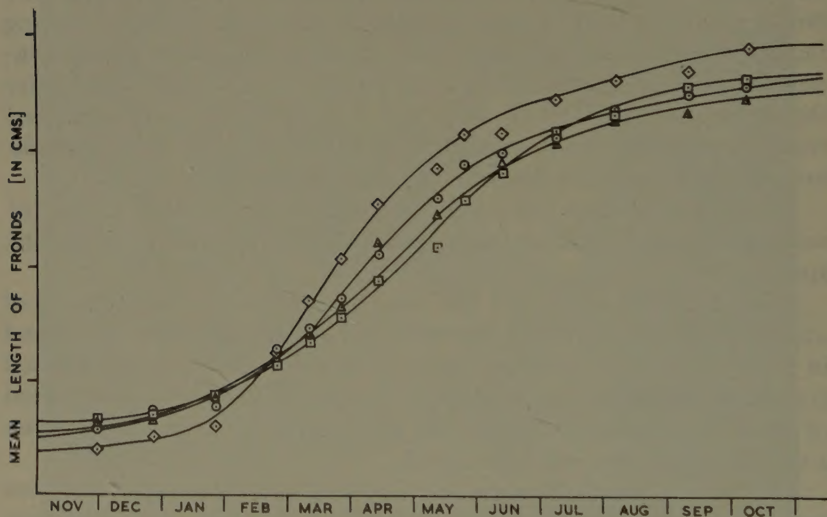

Fig. 1. Each curve represents the mean growth in length of a group of between 15 and 35 fronds of *Furcellaria fastigiata* growing in randomly selected quadrats within a lower midlittoral lagoon community at Aberystwyth. There is no significant difference between the growth increments of plants from the different quadrats.

Figure 1 illustrates the similarity in growth in length of groups of randomly sampled fronds from randomly sampled habitats within the lagoon community at Aberystwyth. No significant difference in growth increment exists between these groups of plants. The curves in Figure 1, together with those in Figure 3, which represent the

growth in length of fronds of different size groups, indicate that growth is not uniform throughout the year. Although some growth takes place at all times, most of it occurs early in the year between late February and early June, with a maximum in March and April. Figure 2 shows the mean increase in length for a large number of plants, the values plotted being the increase each complete calendar month. A steep rise occurs in January and February, reaching a peak in March and April, followed by a more gradual fall off in rate of increase to a minimum in October, November and December.

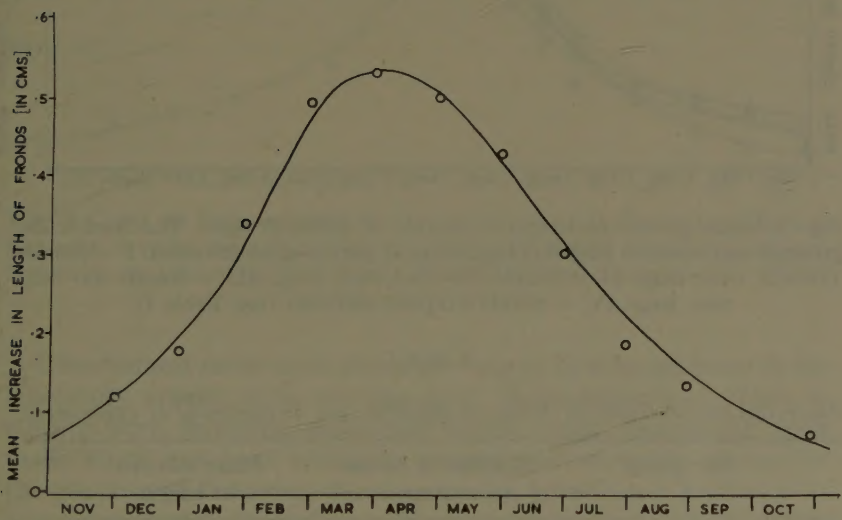

Fig. 2 Mean annual increase in length of 96 fronds constituting 17 plant-tufts.

The total annual growth in length of plants at Aberystwyth is small, ranging from 2.3 to 4.7 cms. with a mean of about 3.4 cms. The length at which the fronds become fertile in this particular locality varies between 9.0 and 19.0 cms. The fruiting fronds reach an ultimate length of from 11.0 to 23.0 cms. by the time the spores are ripe and defoliation imminent. Therefore it would appear that the average frond takes between two and six years to reach maturity in this habitat.

From Figure 3 and Table I it can be seen that, although the growth in length of fronds of different age and size is comparable, it appears that the smaller thalli (Fig. 3, I) exhibit a slightly greater increase than the larger, older ones (Fig. 3, III & II). This does not hold good for the largest fronds (i.e. those over 6.0 cms. at the beginning of the experiment) which show (Fig. 3, IV) the most vigorous growth. This may, however, be due to the fact that many of the fronds in

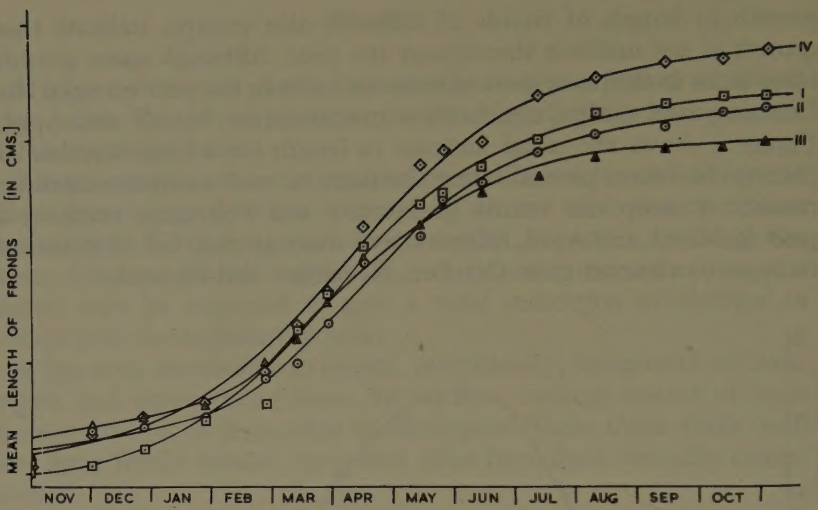

Fig. 3 Mean growth in length of fronds of different ages. The fronds are grouped according to length at beginning of period of observation. I = fronds 1.0—2.7 cms. long; II = fronds 2.8—3.9 cms. long; III = fronds 4.0—6.0 cms. long; IV = fronds 6.0 cms. and over (see Table I).

TABLE I

Mean increase in length of fronds of different ages at beginning of experiment.

Size group	Number of fronds in each group	Mean increase in length
I 1.0—2.7 cms.	22	3.37
II 2.7—3.9 cms.	19	3.09
III 4.0—6.0 cms.	14	2.87
IV 6.0— < cms.	15	3.67
Grand mean	(70 fronds)	3.26

this group were in their last season, approaching mature length and producing fertile ramuli which grow very rapidly.

Figure 4 represents the production of new axes from the basal stolon-hapteron system and can be seen to follow closely the growth curve (Fig. 1). The lag between the onset of maximum growth and the period of maximum production of new axes is due to the fact that the latter were not recorded until they had exceeded 0.5 cms. in length (because of the error involved in handling such small structures), when they had been growing for some time.

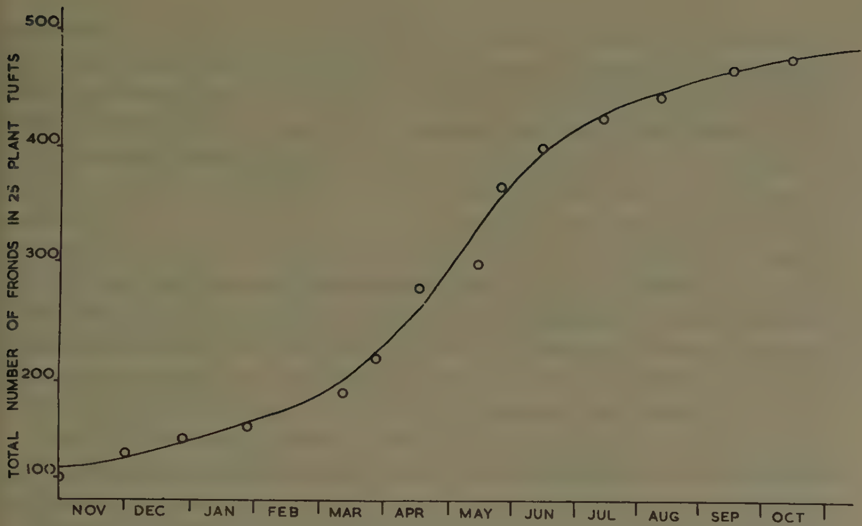

Fig. 4 Curve to show number of new fronds produced from basal stolon-hapteron system throughout the year. The maximum production of new fronds can be seen to lag behind the period of maximum growth (Fig. 2) by a period of 4 to 6 weeks.

Observations made upon plants growing in flowing sea water in the laboratory appear to be relevant here. Measurements of plants in culture were, however, made only in the winter and spring upon thalli which had been artificially pruned and otherwise injured for the purpose of observing the regenerative growth and formation of scar tissue at this time of year. Healthy immature fronds (c.a. 6 to 10 cms. long), straight from the sea shore, were pruned as follows: the tips of the fronds were clipped off with a clean razor to distances of (a) 0.5 mm., (b) 2.0 mm., (c) 20 to 30 mm. and (d) 6 to 7 cms. below the apices. The excised tips were also placed in culture vessels, all of which received constant flowing sea water and equal amounts of illumination from a 60 watt strip fluorescent lamp 3 feet above, (c.a. 50 to 80 foot candles).

A number of plants which had become truncated in a more natural manner by the shedding of sporogenous apices were also placed in culture vessels. No regeneration occurred in these latter plants. In one or two cases they formed scar tissue, but bacterial decay, beginning at the soft gelatinous truncated stump, progressively destroyed the frond. Regenerative growth appeared to take place most readily from truncated stumps from which 2 to 3 mms. had been removed and to a lesser extent from those from which 20 to 30 mms. had been removed. Table II shows the average lengths of these regenerations over a period from November to June.

The smallest excised apices, i.e. 0.5 and 2.0 mms. long, became progressively lighter in colour and eventually disintegrated. Many of the larger decapitated fragments, 20 to 30 mms. long, remained perfectly healthy and formed scar tissue at the cut surfaces, which after a considerable time began to produce slow growing regenerative outgrowths. Growth from the truncated bases of longer prunings, i.e. 6 to 7 cms. long, was negligible.

Since the differences between the growth of fronds of different ages are so small (Fig. 3), it can be assumed that the annual rate of increase in length remains approximately constant throughout the life of a plant. This, together with the value for the mean annual growth increment arrived at here (p. 199), gives us some basis upon which to estimate the longevity of the plant in nature.

In *Furcellaria* interruption of growth in length by damage to the apical meristem appears to occur more rarely than in such species as *Gracilaria verrucosa* (Jones, 1958). When such damage occurs in *Furcellaria* growth is resumed from the surface of the wounded apex rather than by the production of lateral branches as in *G. verrucosa*.

In *F. fastigiata* reproductive structures are borne in terminal ramuli and when these become mature, whether in male, female or tetrasporic plants, the growth of the fertile frond ceases. After the fertile ramuli are shed regenerative growth may be resumed for one or possibly two or even more seasons, terminating whenever the apices regain fertility. The ring or ridge left at the base of a regenerated ramulus gives some indication of the number of times a plant has fruited. As many as three or four such rings have been seen, one above the other, on the thalli of male plants, whilst carposporic and tetrasporic plants rarely bear more than one or two such rings. Male plants are generally smaller and more profusely branched than female or tetrasporic plants, the latter having the greatest stature. This may be due to the diploid nature of the tetrasporophyte endowing it with greater vigour. On the other hand, the male plants may bear more than one crop of fertile ramuli in one year, each involving the loss and regeneration of apical tissue. Furthermore, the persistence of the fertile male apices until April and early May postpones regenerative growth of the frond until conditions favourable to maximum growth rate in the species (p. 199) have passed, allowing only a slow growth for the rest of the year until new fertile ramuli are formed. This would tend to keep the plants dwarf, a factor which may influence their reaching a considerable age before becoming detached and lost (see below). In the female and tetrasporic plants, however, the shedding of exhausted fertile apices takes place in December and January, well before the period of maximum growth

takes place, during which the rapid regeneration of new apices can be observed.

Notwithstanding the slight differences between thalli of different genetic constitution, it can be estimated (see p. 199) that plants which show a mean increase in length of 3.4 cms. per annum reach maximum or fertile length, which is about 17.0 cms. in this habitat, in about 5 years.

In many cases, it can be said that the attainment of fertility and the production of spores is the end of the life of a particular axis, for many become detached subsequent to spore discharge. As mentioned above, some may persist after fruiting and resume growth by regeneration, but this is for a limited period of time, normally for one season, before the apical ramuli again become fertile.

The vegetative life history of a single frond or axis begins with its origin from a sporeling disc or the basal stolon-hapteron; growth continues for some five years or more until the ultimate ramuli become fertile and shed spores; subsequently detachment and loss of the frond commonly occurs. The history of a plant tuft or clump is more complex. Fertile fronds occur toward the centre of plant tufts, which spread laterally over the substratum by the marginal growth of the creeping stolon-hapteron system. When fronds are detached they almost invariably carry with them parts of the stolon-hapteron system, the innermost parts of which appear to become partly degenerate with age and to adhere less firmly to the rock than the younger rapidly growing outermost parts. Detachment and loss of thalli, and the time at which this occurs, is governed by a complex of factors. Perhaps the most important of these is the ratio of frictional resistance of the frond (to water flow) and the strength of attachment of the thallus to the stolon-hapteron in addition to the adhesion of the latter to the underlying rock surface. The frictional resistance to water movement will be influenced by the degree of epiphytic growth on the thalli.

It might be expected that plants in sheltered habitats, where water flow is of low velocity, would live longer and grow to greater size than plants in exposed localities (KNIGHT & PARKE, 1950). This is true for *Furcellaria* except where the conditions of shelter are accompanied by a high degree of turbidity of the water as, for example, in parts of the Menai Straits, Holyhead Harbour, etc., where the plants are small, thin and of a dark red colour (c.f. *G. verrucosa* (JONES, 1957)). The total illumination received by the plants in these habitats is often further reduced by the luxuriance of the surrounding flora and fauna, and of epiphytic growth upon the fronds in particular. The latter may be an additional factor governing the maximum size reached by the plants, increasing their frictional

resistance and thereby causing their detachment and loss, whilst the plants themselves may be poorly attached to the substratum of rock or boulder due to the layer of fine mud and silt formed in such localities.

Comparative measurements of plants from different localities show that *Furcellaria* attains maximum size in semi-exposed districts, whilst plants in extreme shelter or exposure attain smaller dimensions. This will be discussed more fully in a subsequent paper and it must suffice here to say that, apart from geographical position and vertical zonation upon the shore, the factors most influencing the growth and form of *Furcellaria* are illumination and exposure to wave action. The influence of these two factors is not easily distinguished, the latter having effect both directly by causing damage and loss of plants by wave impact and drag, and also indirectly by virtue of its effect upon the growth of epiphytes and surrounding vegetation which in turn modify the former factor. It is difficult to explain the small size of plants of *Furcellaria* in well illuminated but exposed habitats, such as at Marloes and Great Castle Head (Pembrokeshire), other than by supposing that detachment by occasional violent wave action limits their maximum length. It must be added that increased illumination is advantageous only up to a certain level of intensity, above which plants become bleached and remain small in size.

The period of maximum growth in *Furcellaria* (p. 199) is seen to be quite early in the year and very similar to the pattern of growth shown for *Laminaria saccharina* (PARKE, 1948). *Furcellaria*, unlike *Laminaria* however, does not appear to show any variation in growth rate with the age or season of development of the plant. Moreover in *Laminaria* the growth rate varies according to the time of year at which the sporelings begin life. This factor does not apply in the case of *Furcellaria*, since this species has a very limited annual period of spore production lasting for about three weeks in early January (AUSTIN, 1960, in press); this is not surprising, for all the young sporeling plants, at least, would be of an uniform stage of development.

Field observations indicate that many species of red algae exhibit rapid growth as early as February and March, for example *Rhodomela confervoides*, *Polysiphonia nigrescens*, *Polysiphonia elongata*, *Polyides rotundus*, *Rhodymenia palmata* and others all begin to produce new growth, often bearing young sex organs, at this time of year. Maximum growth periods in winter and early spring have been demonstrated in a number of Phaeophyceae, e.g. *Laminaria* (PARKE, 1948), *Fucus* spp. (KNIGHT & PARKE, 1950) and *Ascophyllum nodosum* (DAVID, 1943). *Chondrus crispus* and *Gigartina stellata* have been shown to begin rapid growth early in the year, in April and May, but

appear to reach a maximum in June (Newton, Marshall & Orr, 1949). These species, like *Furcellaria*, are predominantly northern in distribution and like many such animals may have a critical temperature optimum (Orton, 1920) which is quite low. Southerly species, such as *Gracilaria verrucosa*, on the other hand, exhibit a marked summer maximum growth period (Jones, 1958), and have been shown to have a critical temperature value of 8 to 10°C below which little growth takes place (Causy et al, 1946). As for the northerly species, their period of maximum growth, like that of the diatoms, coincides with the peak levels of dissolved phosphate and nitrate and other nutrients in the sea, and light has by this time also increased appreciably. Further study may reveal a correlation between the temperature at which the assimilation/respiration ratio is highest and the average temperature during the month of maximum growth in the species, as well as a possible relationship between temperature and the reproductive cycle.

Table II

Mean increase in length of 60 regenerated outgrowths from decapitated fronds in running sea water in the laboratory.

date:—	6.11.58	19.12.58	10.2.59	17.3.59	5.4.59	10.6.59
Mean increase:–	0	.3-.5 mms.	1.82 mms.	2.65 mms.	3.0 mms.	3.68 mms.

Finally, a note may be made upon the observations made on regenerative growth in the laboratory. The most rapid regeneration took place between February and April (Table II). Total growth was, however, very small, but the conditions for growth in culture were almost certainly far less favourable than in nature. The lack of regeneration from the apices from which only 0.5 mms. or less had been removed suggests that the medullary region has to be damaged before successful wound healing and regeneration takes place (Austin, 1959). Presumably the apical meristems of these ramuli are only partly damaged and can continue to grow in the usual way. Growth from the bases of the excised apices, since it occurred in fragments 2 to 3 cms. long, may be significant. The shortest excised pieces died probably because the proportion of damaged to undamaged tissue and the surface exposed to bacterial attack were both high. The longest detached ramuli did not show any regenerations at their bases and only one or two formed scar tissue. It may well be that growth substances are present in the thallus (Overbeck, 1940), which if concentrated in actively growing regions (as is usual), would evoke response in damaged areas only if the latter were not too far removed from the apical (active) regions.

Acknowledgements

I should like to express my gratitude to Professor Lily Newton, who suggested this investigation, and to the members of the laboratory staff at Aberystwyth, who aided in the fortnightly measuring of plants often under inclement conditions. I am also indebted to Dr. D. J. Crisp, Dr. M. T. Martin and Dr. W. E. Jones for their helpful suggestions and criticisms.

Summary

Measurements made upon plants of *Furcellaria fastigiata* (L.) Lam. grown *in situ* in a lower littoral logoon community at Aberystwyth show that this species is a slow growing perennial. Maximum growth rate occurs early in the year between March and May. Annual increase in length is about 3.4 cms. and the plants reach maturity in about 4 to 6 years in this particular habitat. Growth rate, maximum size and longevity depend to a considerable extent upon environmental factors, particularly upon light and exposure to wave action.

Zusammenfassung

Die Messungen, die an Pflanzen der Art *Furcellaria fastigiata* (L.) Lam. vorgenommen wurden, die in einer nur bei absolutem Tiefstand der Ebbe völlig abgeschlossenen Lagunengemeinschaft bei Aberystwyth *in situ* gewachsen waren, zeigen, dass diese Spezies zu den langsam wachsenden Perennierenden gehört. Der Maximale Wachstumsbetrag kommt im Frühjahr zwischen März und Mai vor. Das jährliche Längenwachstum betragt 3,4 cm. Die Reife der Planze in dieser speziellen Gemeinschaft tritt nach ungefähr 4—6 Jahren ein. Der Wachstumsbetrag, die Maximale Grösse und die Lebensdauer hängen in beträchtlichem Masse von Umweltsfaktoren ab, besonders vom Licht und davon, ob der Standort der Einwirkung der Wellen ausgesetzt ist.

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Nutrition of Galerucella nymphaeae L. (Chrysomelidae), mass consumer of water-lily

by

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Few consumers of water-lilies are known- the beetles *Galerucella nymphaeae* L. and *Donacia crassipes* F., aphids *Ropalosiphum nympheae* L., the larvae of the fly *Hydromyza livens* Fall. (Жизнь пресных вод СССР. 1940., Tarbinsky & Plavilschikov 1948, Lipin 1950). The larvae and imagines of *Galerucella nymphaeae* are the main consumers of the floating parts of *Nymphaea* and *Nuphar*. In the lakes they share the first place with *Donacia crassipes*. In the borrow pits on the sphagnous bog, where *Nymphaea candida* Presl. forms the continuous fringe at shores, *G. nymphaeae* is its only mass and constant consumer, each dying-off leaf being usually heavily damaged. The sepals are often damaged also, but usually in a lesser degree. *Nuphar luteum* Sm. does not grow in these borrow pits.

In the Lake Poletskoye *G. nymphaeae* fed on *Nymphaea candida*, *Nuphar luteum* and sometimes on the floating leaves of *Polygonum amphibium* L. In the inshore zone of the Rybinsk Reservoir near Borok where *Nymphaea* and *Nuphar* are absent we met considerable quantity of *G. nymphaeae* on the floating leaves of *Polygonum amphibium* appreciably damaged by it (July 1959). The following food plants of *G. nymphaeae* are indicated in the literature: *Nymphaea candida*, *N. alba* L., *N. advena* Ait., *Nuphar luteum*, *Polygonum amphibium*, *P. hydropiperoides*, *Myrica gale* L. (Scott 1924, Henriksen 1927, Ogloblin 1936, Жизнь пресных вод СССР. 1940, Lipin 1950). According to Scott (1924) the flowers of *Nymphaea advena* may be consumed and the imagines consume its pollen. Scott (1924) and MacGaha (1925) note that the larvae sometimes eat the eggs of their own species. MacGaha observed also the case when the larvae ate the pupae of their own species.

G. nymphaeae and its food plant *Nymphaea candida* are common and widely spread species. *G. nymphaeae* is distributed in the U.S.S.R. from the shores of the Arctic Ocean, Chukotsk, and Kamchatka to Kerch, North Caucasus, the Amu Darya Delta, Julek (in Middle Asia), the Lake Issyk-Kul, the Amur, the Ussuri (OGLOBLIN 1936). *N. candida* is distributed from 65° North in the European part of the U.S.S.R. and 60° North in the Asiatic part to the Black Sea coast of the Ukraine and the middle latitudes of Kazakhstan (SMIRENSKY 1952).

In cases of the excessive development the water-lilies may become a negative factor reducing the surface of a water body. In such cases the acclimatization of the corresponding invertebrate eating the water-lilies might in some degree limit their growth, the invertebrate itself becoming the additional food resource for the predators.

The other species of the genus *Galerucella- G. grisescens* JOANN. (identified by O. L. KRYZHANOVSKY) we found on *Comarum palustre* L., growing abundantly in various excessively moistened places, and heavily damaged by the larvae and imagines of this species. From the eggs laid in clusters on the leaves of *C. palustre* the larvae hatch in 6 days (at 23,5—24,5°C). OGLOBLIN (1936) points out the following food plants for this species: *Hydrocharis morsus-ranae* L., *Lysimachia vulgaris* L., *Polygonum nodosum* PERS., and *Fragaria*, but he does not mention *Comarum palustre*.

In spite of the noticeable role of *G. nymphaeae* in the transformation of *Nymphaea* production its nutrition is studied but little. We determined for the different stages of development the daily food indices, the intensity of nutrition during day and night, the possible duration of life without food, the daily oxygene consumption, the daily rythm of respiration, the respiration of starved animals, the respiration quotients, the excessive consumption of food. The material was collected, and the experiments were carried out on the borrow pits at the Lake Poletskoye, 73 km West from Moscow.

This paper is a part of trophological investigations carried out by the Department of Hydrobiology of the Institute of Fish Industries under the leadership of Professor N. S. GAJEVSKAJA. The reading of the manuscript by Professor F. D. MORDUKHAY-BOLTOVSKOY is acknowledged.

NUTRITION

The feeding behaviour of *G. nymphaeae* and the form of the damages of the leaves are described in our earlier paper (SMIRNOV 1959). In the same paper the mean daily food indices are determined (see table III).

The first set of experiments for the determination of the mean daily food index (the mean daily ration expressed as percentage to the weight of the consumer) was carried out in July directly in the borrow pits under the natural conditions of the feeding. Due to the fact that the larvae usually crawl little and remain on the leaves for several days the leaves with them might be left in the outdoor experiments without any protection. The undamaged leaf of *Nymphaea candida* was chosen. The neighbouring pads were removed so that the larvae could not creep on them from the leaf chosen for the experiment. On the series of such leaves the various number of larvae taken from the other leaves while they were feeding was placed. So in the experiment the larvae continued their usual feeding. During the first set of the experiments there were no rains, the cloudiness 4 in the average. Each experiment was continued for two days. The following number of larvae was placed on the leaves: 1 (three experiments), 2, 5, 10, 20, 30 (one experiment in each case).

The observations were done at 6, 9, 12, 15, 18, 21 h. The total length of the damages was measured with the map measurer, the mean width of the damages was also measured. The depth of the damages was determined by the difference between the thickness of the leaf and the thickness of the lower epidermis measured with the micrometer. By these data the volume of the material eaten was calculated. To determine the weight, the specific weight of the leaf was determined. To do this the rectangles cut out of the leaf blade were weighed and their volume was determined by measuring the area and the thickness. The daily food index was then calculated in per cents on the live weight basis. The average weight of the larvae is: length 7 mm – 20 mg., length 5 mm – 5 mg., length 4 mm – 3 mg., length 2 mm – 0.4 mg.

The mean daily food index of larvae 7 mm long (the last instar) was equal 186%, the highest value being 225%, the lowest 106%. The larvae began to feed from the very first hour. Any regular difference between the food index on the first and on the second day was not observed.

In the same way directly in borrow pits the experiments with larvae 5 mm long and 4 mm long were performed. The daily food indices were respectively 112% and 170%.

In the second set of the experiments carried out in the laboratory in July at the temperature 17—26°C, during two days the daily food indices for the larvae fed on *Nuphar luteum* were determined. On a leaf 10 individuals 5 cm long were placed. The mean daily food index was 172%. Thus the food indices of the larvae fed on *Nymphaea candida* and *Nuphar luteum* are similar.

The floating leaves of *Sagittaria sagittifolia* L. were also given to

the larvae of the last instar as food. The larvae never attempted to gnaw the leaf and on the seventh day fell into the water and drowned. OGLOBLIN (1936) mentions *S. sagittifolia* as a food plant of *G. nymphaeae ab. sagittariae* GYLLENHAL. We did not meet this aberration. In the description by GYLLENHAL (1813) there is no exact indication on the eating of *S. sagittifolia.*

The analogous result was obtained in the experiment in which the larvae were offered *Sphagnum apiculatum* H. LINDB. The larvae did not eat *Sphagnum* and began to eat one another.

The population of the larvae consumes daily 0.4% of the biomass of the leaves of *Nymphaea candida* (SMIRNOV 1959, 1960). The part of *Galerucella nymphaeae* in the transformation of *Nymphaea candida* is still more important because they feed all summer beginning at the end of May. Later the lower epidermis of the leaf decomposes and the dying-off leaves of *Nymphaea* in the borrow pits are usually pierced with numerous holes. The influence of *G. nymphaeae* on the leaf production increases also due to the fact that the parts of the leaf adjoining to the damaged places begin to decay. Such considerable consumption did not interfere with the successful flowering and fruit formation of *Nymphaea candida.*

It was noted by SCOTT (1924) that the larvae feed both during day and night, but she did not determine if the food consumptoin in the day- time and at night was equal or not. We undertook the determination of the diurnal changes in the intensity of feeding of the larvae. To achieve this aim we carried out two experiments- one in the borrow pits, the other in the laboratory.

Under natural conditions in the set of experiments in which the damages were measured each 3 hours (the first set) it was found that the larvae feed most intensively during mid-day and less intensively during the dark hours. The similar result was obtained in the laboratory experiments. In these experiments 20 larvae of the last instar were put on three leaves (average weight 14.3 mg.). Two experiments continued for 48 hours, the third- 24 hours (in the end of June. Fig. 1).

The intensity of feeding increased considerably towards the end of the day-time and was the highest at 18—24 hours. It is to be noted that the temperature varied during the 24 hours and the maximum of feeding followed the day maximum of temperature. There is no clearly pronounced daily rythm in the respiration of the larvae. Evidently the observed daily variations in the intensity of the feeding are to be considered not as the daily rythm of nutrition, but as the result of the general increase of the activity of the larvae in connection with the higher temperatures of air and water (fig. 1).

The mean daily food index of the larvae of the last instar in the laboratory experiment was 65.5%. Its low value comparing 186%

14*

obtained in nature may be explained by the difference in the experimental conditions (the temperature in the laboratory being lower).

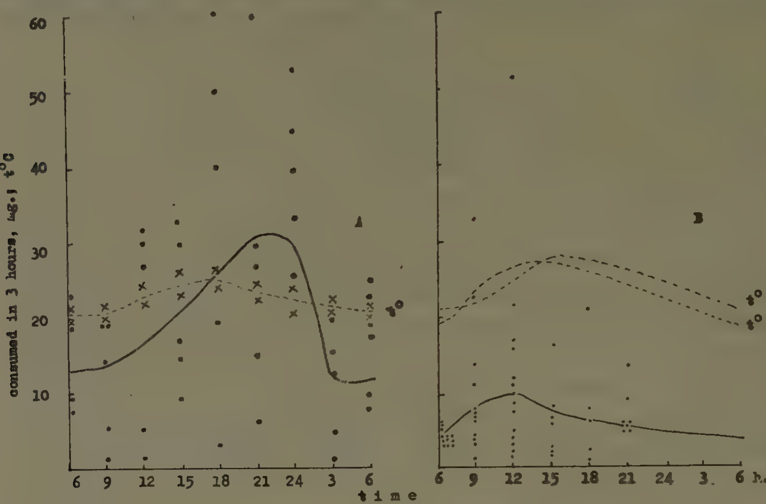

Fig. 1

Diurnal changes in the intensity of feeding of the larvae of the last instar. A- laboratory experiment, per 20 larvae, B- borrow pit experiment, per 1 larva.

The determination of the duration of the feeding of the imagines was attempted. The beetles reared from the pupae were kept in the glass jars covered with cheesecloth by about 30 individuals in each. The leaves of the water-lily were changed as the feeding progressed and the quantity eaten was determined by the difference in the leaf weight. The experiments lasted for 25, 24, and 10 days. The temperature in the beginning of the experiment was 24.5°, in the end 17—20°.

In all experiments the beetles were feeding to the last day when the work had to be discontinued. The mean food index in this experiment was 36% which is possibly connected with not quite favourable conditions in this laboratory experiment (the copulations took place only twice- on the 10th and 11th day).

To determine the starvation period for the males and the females they were put by tens in the beakers covered with cheesecloth and kept in the laboratory at the temperature ranging between 16 and 23°C (the first part of August. Table I).

At the mentioned temperatures the starvation period of the males equales approximately 18 days, of the females seems to be somewhat longer. The starving females consume less oxygen comparing with the males and judging on their RQ they differ as to their metabolism which accounts for the difference in the starvation period.

Table I

Starvation period of imagines (hours)

number of individuals died	males					females		
	number of the lot							
	1	2	3	4	5	1	2	3
1	—	162	162	162	—	—	262	300,5
2	172	—	—	246,5	—	191,5	282	—
5	256,5	—	—	—	253,5	328	378,5	378,5
6	—	246,5	256,5	334,5	—	—	—	—
9	334,5	377,5	377,5	377,5	442	—	—	—
10	377,5	450,5	403	459	442	—	—	—
Average term of death of half of the individuals	250					360		
Average term of death of all individuals	427					—		

G. nymphaeae hibernates as imago (Ogloblin 1936) so the starvation period is strongly dependant on temperature and on the adaptive physiological states which appear at the lowered temperatures.

During the starvation the weight of the beetles and the larvae strongly diminishes. After 96 hours of starving the average weight of the females lowers from 15.0 mg. to 11.5 mg., (that is respectively 23.3% and 30.4% to the initial weight). The larvae of the last instar after 41 hour of starving lose 29.5% of the initial weight (from the average 14.9 mg. to 10.5 mg.).

Respiration

For the determination of the gas exchange the differential microrespirometer after Drastich (1934) was used. This respirometer is successfully used during about 20 years in the investigations of the Department of Hydrobiology of the Institute of Fish Industries and has become one of the laboratory devices of the Laboratory of Zooplankton and Zoobenthos of the Institute of Reservoir biology.

The counts were recorded every hour. At this operation the stopcocks were opened to make the pressure in the respirometer equal to that in the outer space the drop in the index taking the zero position. During the day-time the vessels of the microrespirometer were lit by the faint day light, during the night- by the faint electric light.

In all the experiments the larvae and the imagines were fed by the leaves of *Nymphaea candida*.

First of all the daily oxygen consumption and respiration quotients

necessary for the evaluation of food requirements of the larvae and the imagines were determined. After N. S. GAJEVSKAJA (1958) the determinations for each lot of animals (10 individuals) were performed during 6 hours to avoid passing of the animals in the respirometer from the fed state into the hungry state as might happen during the longer period. After the six determinations the animals from the respirometer were put on the leaf of the water-lily and substituted by the fed lot. After this the vessels of the respirometer were submerged into the aquarium served as thermostate and kept about 50 minutes till the next hour to equalize the temperature. Thus there were one-hour blank spaces between six hour determinations (during 48 hours). The experiments were carried out at the room temperature: with the larvae- 18.6—20.8°, with the males 19.0—20.3°, with the females 18.1—20.6°C. The data were recalculated for 20°C by VINBERG'S table (1956).

Nearly in all cases the lowering of the oxygen consumption of the fed larvae or imagines from the first to the sixth determination was revealed (fig. 2) in spite of the fact that in all the experiments the animals almost did not move. The ratio of the oxygen consumption in the first determination to the last reached 3:2. Only three six-hour determinations without such decrease were the exception.

Such decrease was also observed by N. A. BEREZINA (personal communication) in the experiments with the large larvae of *Notonecta glauca* L., but not in every case. The ratio of the first (the highest) value of the oxygen consumption to the last was 3:2.

The decrease in the oxygen consumption can not be explained by passing of the animals into the hungry state as such decrease was also observed in the beetles starved for a long time (96 hours) (fig. 2). We are inclined to explain this decrease by the excited state of the animals in the beginning of the determinations. The excited state may partly be expressed by the slight movements. Therefore we considered it most right to draw the daily rate of the oxygen consumption by lower points and calculate the value of the oxygen consumption during 24 hours by the resulting curves (table II).

The graphs show (fig. 2) that the diurnal rythm of the oxygen consumption by the fed animals is almost not expressed. Some increase at 12—13 hours may be observed only in the females.

The higher points of the oxygen consumption in the hungry animals we also consider to be heightened in connection with the excited state. Therefore the daily consumption of oxygen by the not-moving larvae starved during 41 hour, and by not-moving males and females starved during 96 hours was calculated in the similar way- by the lower points (fig. 3, table II). The lowest oxygen consumption was observed in the starved females.

The respiration quotients has been calculated in cases of the expressed decrease of the oxygen consumption as the ratio of the volume of the excreted carbon dioxide for every hour to the volumes of the oxygen consumption separately for every hour (in the corresponding time). If the decrease in the oxygen consumption was not

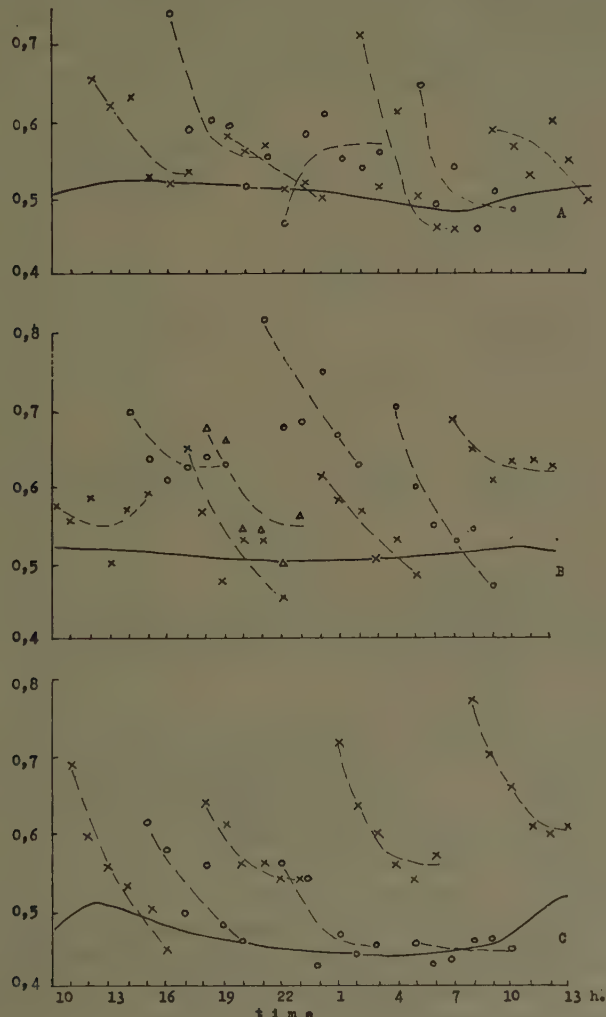

Fig. 2.

Diurnal course of oxygen consumption by fed larvae ml./g live weight (recalculated for 20°C). Intermittent line connects experimental points, continuous line- oxygen consumption in basal metabolism. x-data for the first 24 hours, o-data for the second 24 hours, △-further data, A-larvae of the last instar, B-females, C-males.

TABLE II

Oxygen consumption, respiration quotients, and energy expences in the different developmental stages (at 20° C)

Developmental stage	Condition	O_2 consumption by not moving animals, mg./gr. live weight in 24 hours	RQ of not moving animals	Caloric O_2 quotient, cal./ml.O_2	Calories excreted at respiration, per 1 gr. live weight in 24 hours	Spent for digestion ml O_2/gr live weight in 24 hours	Spent for digestion % to basal metabolism
larvae of the last instar	fed (basal metabolism + digestion)	12,2	0,86	4,87	59,41	1,1	9,91
	hungry (basal metabolism)	11,1	—	—	—	—	—
females	fed	12,3	0,87	4,87	59,90	2,7	28,1
	hungry	9,6	0,77	4,76	45,70	—	—
males	fed	11,2	0,89	4,91	54,99	3,4	43,6
	hungry	7,8	1,00	5,02	39,16	—	—
eggs (the end of development)		14,0	0,75	4,74	66,36	—	—
pupae (of dark-orange colour)		9,6	0,78	4,77	45,79	—	—

expressed clearly the RQ have been calculated as the ratio of the volume of the excreted CO_2 for every hour to the average volume of the O_2 consumed.

The decrease of the RQ value in six successive determinations was always observed (fig. 3). In our case we consider the decrease in RQ and in O_2 consumption to be connected primarily with the excited state of the animals in the beginning of the experiments, as such decrease was observed in the fed animals and in the animals starved for a long time (larvae 47 hours, imagines 103 hours).

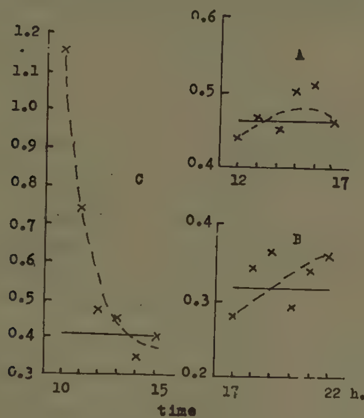

Fig. 3.

Oxygen consumption by hungry animals, ml./g live weight at 20°C. A larvae of the last instar, B females, C males. Continuous line shows the mean of the lower points assumed for the motionless animals.

Therefore the RQ corresponding to lower points (fig. 4, table II) were taken for the calculation of the value of the energy consumption in 24 hours by motionless animals.

In the fed larvae RQ in the beginning of the sixhour determinations exceeded 1, which indicates the reduction processes (CHOVIN 1951, page 246, KOSHTOYANTS 1951, page 385). In the hungry not moving males RQ was 0.77 which is indicative o. the prevaling oxidation of fats. The starving females evidently possess the peculiar metabolism. The first determination for them showed RQ 1.7 which decreased during six hours to 1. It is known that in the female moths *Agrotis segetum* SCHIFF. synthesizing fats to be deposited in the eggs RQ may considerably exceed 1 and even reach 2.09 (KOZHANCHIKOV 1938, CHOVIN 1951). The starving females of *G. nymphaeae* may possibly form eggs extremely limiting all other processes.

In the motionless fed animals RQ was 0.86—0.89 which corresponds to the oxidation either 1) of proteins, or 2) of fats and carbo-

hydrates in the equal proportion, or 3) of a mixture of fats and carbohydrates in the equal quantities, and proteins. The two first assumptions have to be rejected in the case of the animals feeding only by the vegetative tissue. As the leaves of the water-lily contain only 3.9 per cents of fats, proteins constitute nevertheless the bulk of the digested material. Proteins constitute 15.3 per cent of the material of the leaves. Therefore we come to the conclusion that evidently the larvae and imagines use mainly protoplasmic matter from the ingested material, which partly explains high indices of the excessive consumption of food.

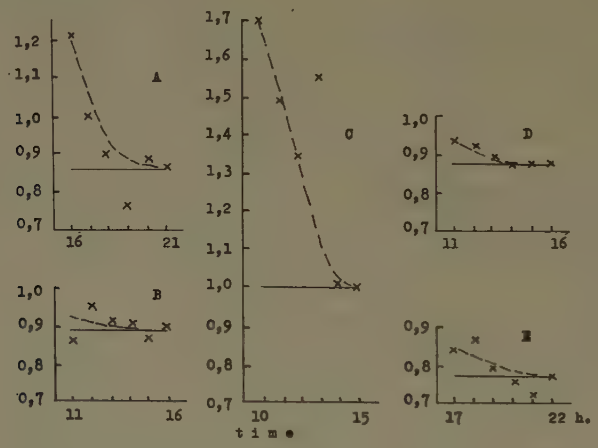

Fig. 4.

Changes in RQ during 6-hour determinations. A- larvae of the last instar, B- fed females, C- hungry females, D- fed males, E- hungry males. Continuous line shows RQ assumed for motionless animals.

For the aphids *Pterocallis juglandis* GOEZE RQ 0.86 was determined which was explained by the possibility of the protein synthesis in their body by the symbionts fixing the atmospheric nitrogen (TOTH & WOLSKY 1941, CHOVIN 1951) as their food consisted almost entirely of carbohydrates and the difference in the organic nitrogen content was little to admit the possibility of the dominating assimilation of proteins from the food material.

The metabolism of non-feeding stages of development was also measured. The fertilized females collected in the borrow-pits were kept by tens in the beakers containing one leaf each. Soon the eggs were laid in the clusters from 8 to 20 eggs, 7—14 clusters being laid in each beaker. Each cluster consists of the eggs laid in one layer and arranged close one to another their long axis being perpendicular to the surface of the leaf. One female laid 11—18 eggs, average 15. Afterwards they laid approximately the same number. The eggs

complete the development in 6 days at 23.5—24°C. The weight of one egg is 0.2 mg. Scott (1924) observed that a female laid to 115 eggs. The number of eggs in one group varied from 2 to 20 (Mac Gillivray 1903, Scott 1924).

The determination of the oxygen consumption by the eggs was performed on two lots by 100 eggs completing the development collected on July 25. The results are shown on the figure 5 as two curves designated I and II. In case I the determinations were finished as larvae hatched. On the group II the determinations were done to cover 24 hour period and RQ was determined. The determinations were per formed at 20.4—21.9°C.

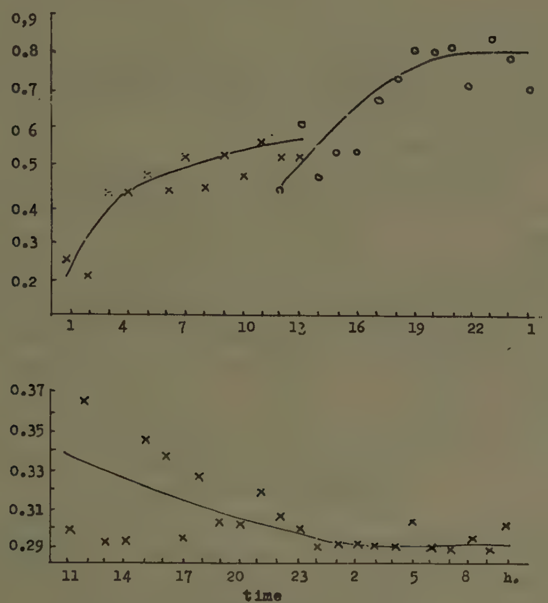

Fig. 5.
Oxygen consumption by the developing eggs (upper curves, recalculated for 20°C), and by the pupae (lower curves, recalculated for 17°C), ml./g live weight

The oxygen consumption by the eggs increases as their development progresses. The respiration of the eggs in the end of the development is most intensive comparing with the larvae and imagine (table II).

To determine RQ the ratios of carbon dioxide volumes to the mean oxygen consumption for three previous hours were taken which gave RQ: 1, 1.008, 1.29, 0.75, 0.67, 0.75. These changes in RQ may be connected with the development of the eggs.

Newly hatched larva weighs 0.24 mg. The shed egg cover weighs

0.02 mg. The first moulting occurs in 5 days (at 23.5—25.5°C). The newly moulted larvae are yellow, afterwards they become dark yellow, and then black. When the larva of the last (third) instar pupate its integument cracks and liberate the yellow pupa, which quickly becomes light orange, then dark orange, and before the end of the development jet-black. The average weight of a pupa is 15.3 mg. The newly emerged beetles are yellow, darkening after several hours. Pupal integuments weigh 1.7 mg.

The development of the larva by our observations takes 15 days at 20—28°C, of the pupa- 7 days at about 20°C, which agrees with recorded earlier 7—20 days for the larvae (Scott 1924, Ogloblin 1936), and 5—9 days for the pupae (DeGeer 1775, Weise 1893, Scott 1924, Ogloblin 1936).

The determinations of gas-exchange for the pupae were performed at 16.7—17.9°C, the data were re-calculated for 17°, and the value of the consumption for 24 hours to 20° (table II). RQ are calculated by the data re-calculated to 17°.

It is seen from the figure 5 that the scattering of the points is considerable in the first part of the curve, then it diminishes, and the curve lowers.

The determination of RQ were performed after the 24 hour experiment was finished on the same material. The ratio of the volumes of carbon dioxide excreted to the average of six last determinations of the oxygen consumption was taken. The average RQ was 0.75 (0.71—0.88).

Comparison of food requirements determined directly and by respirometric method

The energy expenditure in respiration was calculated by the caloric quotient of oxygen (Slonim 1955) chosen with regard for the material oxidated by the corresponding RQ (table II).

The caloric value of the leaf blades of *Nymphaea candida*, as determined by Kashkin N. I. (unpublished), is 4055 cal./g of dry weight, the dry weight constituting 11.4% to the fresh weight. The results of the calculations (table III) show that the energy consumed in food exceeds the energy spent in respiration 9.7 times in last instar larvae, about 16 times in imagines (index of excessive consumption).

The caloric value of the leaf blades of *Nuphar luteum* is 4200 cal.g of dry weight, the dry weight being 12% to the fresh weight (Tsikhon-Lukanina 1958). In this case also the energy consumed in food exceeds 9.7—14 times the energy spent in respiration (table III).

So in *G. nymphaeae* the excessive consumption of food takes place

TABLE III

Comparison of food requirements determined directly and by respirometric method

Developmental stage	Mean daily food index	Mean temperature during the determination of the mean food index, °C	O_2 consumption at this temperature ml./gr. live weight in 24 hours	Calories per 1 gr. live weight in 24 hours spent in respiration	Calories per 1 gr. live weight in 24 hours ingested in food	Ratio of the calories ingested with food to the calories spent in respiration
		feeding on *Nymphaea candida*				
larvae of the last instar	186	25	18.5	90.10	874.9	9.7
males	224	21.5	13.9	67.69	1035.5	15.3
females	224	21.5	12.7	61.36	1035.5	16.9
		feeding on *Nuphar luteum*				
larvae of the last instar	172	21.5	13.8	67.21	950.1	14.1
males	130	21.5	13.9	67.69	665.2	9.7
females	130	21.5	12.7	61.36	665.2	10.7

(GAJEVSKAJA 1948). Undoubtedly only small portion of the ingested material is digested and assimilated which may be proved by the microscopic examination of the faeces.

It must be noted that the oxygen consumption values and the corresponding energy expenditures may somewhat differ in the case of feeding on *Nuphar luteum* and in the case of feeding on *Nymphaea candida*, as was found for other insects (DANILEVSKY 1936, KOZAHNCHIKOV 1937, KUNZETSOV 1953). It is the more probable that a number of other features of the consumer changes depending on the species of the several suitable food plants (DANILEVSKY 1936, KOZHANCHIKOV 1937, PAINTER 1953).

SUMMARY

1. The mean daily food indices are determined for different developmental stages of *Galerucella nymphaeae* L. feeding on *Nymphaea candida* and *Nuphar luteum* (table III).

2. 50 % of the starving males die in 10.5 days, 50 % of the starving females die in 15 days (table I).

3. The oxygen consumption of the larvae and imagines decreases during six-hour experiments. The upper points seem to correspond to the excited state of animals in the beginning of the experiment. Therefore the curves of the oxygen consumption by the motionless animals during 24 hours are drawn on the lower points. The diurnal rythm of the oxygen consumption is almost not expressed (fig. 2, table II).

4. Caloric quotient of oxygen was chosen with regard for the material oxidated, by the corresponding RQ. The energy expenditure in respiration was calculated for the temperature of the determination of the mean food indices. The indices of the excessive consumption of food are 9.7—16.9 (table III).

Выводы

1. Определены средние суточные пищевые индексы для личинок и имаго *Galerucella nymphaeae* L. при питании *Nymphaea candida* и *Nuphar luteum* (таблица III).

2. При голодании 50 % самцов погибает через 10,5 суток, 50 % самок- через 15 суток (таблица I).

3. Потребление кислорода личинками и имаго снижается в течение шестичасовых опытов. Повидимому верхние точки соответствуют возбуждённому состоянию животных в начале опыта. Поэтому кривые потребления кислорода в течение суток неподвижными животными проведены по нижним точкам. Суточный ритм потребления кислорода почти не выражен (рис. 2, таблица II).

4. Калорический коэфициент кислорода выбирался с учётом характера окисляемого материала судя по дыхательным коэфициентам. Расход энергии при дыхании вычислялся на температуру, при которой произведены определения суточных пищевых индексов. Индексы избыточности питания оказались равными 9,7-16,9 (таблица III).

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A second check-list of tropical West African algae

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December 17th, 1959

The preparation of a second Check List on the heels of the original has been necessitated for several reasons. Though material is being accumulated by the compilers for the elaboration of a List for the whole Continent of Africa, as suggested by BOURRELLY in his review of the existing Check List, it is already so extensive that the bibliographical research alone will require a long period free from teaching and administrative duties, which is not yet possible. Our own interests are in the study of West African algae, and the extension of them to collections made in the Great Scarcies River has made us aware that the original restriction to fresh- and brackish- waters must be overcome. The interest in African algology has recently been enhanced by important studies (e.g. BOURRELLY, GAUTHIER-LIÈVRE, HENDEY, SOUSA E SILVA) both in freshwaters and also in the marine littoral; the published data have accumulated so rapidly that we felt it must be documented before it grew to overwhelming proportions. We are grateful to our botanical colleagues who have supplied us with their data, and advised us of ways in which the Check Lists can be serviceable. We have also borne in mind the corrections of errors that crept into the original document. The publication of the International Code produced some emendations, particularly the establishment of generic conservations.

All these points have led to this supplementary production, one which has become more prolific than we had imagined when its first draft was made in the spring of 1959. A halt had to be called at some point (for data are continually being added to our card indices). The present List is compiled up to the autumn of 1959.

We have used 15 to represent French Soudan, for which considerable records now exist. Algal material has now been described from:-

Senegal.	DE POUQUES: SOUSA E SILVA.
French Soudan	BOURRELLY.
Tibesti.	GAUTHIER-LIÈVRE.
Sierra Leone.	HENDEY.
Ghana.	HENDEY.
Nigeria.	HENDEY.
Lower Congo.	KUFFERATH.
Portuguese Guinea.	PINTO: SOUSA E SILVA.
A.O.F.	SERPETTE.
Angola.	SOUSA E SILVA.

The following signs have been used:

§ denotes an alteration or correction of the original Check List.

* indicates a name already in the Check List to which additional information is given.

** indicates a name which has not previously appeared in the Check List.

ACHNANTHES Bory 1822

**	bengalensis Grun. in Cleve & Grun. 1880	6
*	Biasolettiana (Ktz.) Grun. in Cl. & Grun. 1880	20
§	brevipes Ag. 1824 vice 1924	
*	„ v. intermedia (Ktz.) Cl. 1895	2, 22.
**	curvirostrum Brun. 1895	6
§	exigua Grun. in Cl. & Grun. 1880	6* vice 6; 14 vice 15
§	„ f. aperta Guermeur 1954 vice f. capitata Guermeur 1954	
*	exilis Ktz. 1833	20
§	flexella (Ktz.) Brun 1880 vice (Bréb. ex Ktz.) Brun 1880	
*	inflata (Ktz.) Grun. 1867	9, 16.
**	„ v. Smithiana (Grev.) Cl. 1895	16
**	kuweitensis Hendey (1957) 1958	13
*	longipes Ag. 1824	2
**	marginalis Hendey (1957) 1958	6
*	minutissima Ktz. 1833	12
*	„ v. cryptocephala (Näg. ex Ktz.) Grun. in V.H. 1881	21
§	subsessilis Ktz. 1833 is a synonym of A. brevipes v. intermedia.	

ACTINOCYCLUS Ehrenberg 1837

*	Ehrenbergii Ralfs in Pritchard 1861	2
*	„ v. tenella (Bréb.) Hust. in Rabh. 1929	6
**	platensis Müller Melchers 1953	6

ACTINOPTYCHUS Ehrenberg 1839

**	adriaticus Grun. 1863	21 ?
**	bifrons A.S. 1886	13
*§	campanulifer A.S. 1875 vice 1885	13
*	senarius Ehr. 1839	4, 5, 8, 21
*	splendens (Shadb.) Ralfs in Pritchard 1861	2, 4, 5
*	vulgaris Schum. 1867	8

ACTINOTAENIUM (Nägeli) Teiling 1954

*	cucurbitinum (Biss.) Teiling 1954	20
**	elongatum (Racib.) Teiling 1954	15
**	„ v. africanum (Schmidle) Teiling 1954	15
**	Teilingii Bourr. 1957	15

AGMENELLUM de Brébisson 1839

**	thermale (Ktz.) Dr. & Daily 1956	11

ALLORGEIA Gauthier-Lièvre 1958

**	Valiae Gauth.-Lièvre 1958	23
**	„ f. compacta Gauth.-Lièvre 1958	23

AMPHIDINIUM Claparède & Lachmann 1858—61.

**	latum Lebour 1925	21

AMPHIDOMA Stein 1883

**	nucula Stein 1883	21

AMPHIPRORA Ehrenberg 1843

*	alata (Ehr.) Ktz. 1844	2, 8
**	gigantea Grun. 1860 v. sulcata (O'Meara) Cl. 1894	2, 4, 6
*	paludosa W. Sm. 1853	2
**	pulchra Bailey 1850	6
**	venusta Grev. 1865	2

** *AMPHISOLENIA* Stein 1883

**	bidentata Schröder 1900	2, 21.
**	extensa Kofoid 1907	21
**	globifera Stein 1883	21
**	laticincta Kofoid 1907	21
**	quadrispina Kofoid 1907	21

** spinulosa Kofoid 1907 21
** truncata Kofoid & Michener 1911 21

** *AMPHITHRIX* [Kützing 1843] Bornet & Flahault 1886

** janthina (Mont.) B. & Fl. 1886 18

AMPHORA Ehrenberg 1840

angusta Greg. 1857
** „ v. ventricosa (Greg.) Cl. 1895 6
** arenaria Donkin 1853 2
** crassa v. spuria Cl. 1895 6
** cuneata Cl. in A.S. 1876 6*
** egregia Ehr. 1861 2
** Ehrenbergii *nom. novum nobis*, 6, 9, 10, 12, 14, 20, 21.
* exigua Greg. 1857 20
** Grevilleana Greg. 1857 11
* libyca Ehr. 1840 5, 21.
** lineolata (Ehr.) Ktz. 1844 2
* marina (W. Sm.) V.H. 1880 4
obtusa Greg. 1857
** „ v. rectangularis H. & M. Perag. 1897/1908 6
** ocellata Donkin 1861 2
* ovalis (Ktz.) Ktz. 1844 13
§ pediculus (Ktz.) sensu A. Cl.-Eul. 1953. = A. Ehrenbergii W. & T. *nom. nov. supra*
** spectabilis Greg. 1857 6

ANABAENA [Bory St. Vincent 1822] Bornet & Flahault 1888

§ aspera Frémy 1930 18 vice A.E.F
** augustumalis Schmidle 1899 18
** azollae [Strass. 1884] Geitl. in Pasch. 1925 20
§ batophora Frémy 1930 18 vice A.E.F.
* flos-aqua [(Lyngb.) Bréb. in Bréb. & Godey 1835] B. & Fl. 1888 18
* inaequalis (Ktz.) B. & Fl. 1888 18
** laxa [(Rabh.) A. Br. in B. & Fl. 1885] B. & 1888 18
** Levanderi Lemm. 1906 18
** monilifera Frémy 1945 5, 15
§ promecespora Frémy 1930 18 vice A.E.F.
** torulosa [(Carm. ex Harvey in Hook.) Lagerh. 1883] B. & Fl. 1888 18
** Volzii Lemm. 1900 15
** „ v. crassa (Rao) Bourr. 1957 15

ANACYSTIS Meneghini 1837

**	aeruginosa (Zanard.) Dr. & Daily 1948	20
*	cyanea (Ktz.) Dr. & Daily 1952	6*
*	montana (Lightfoot) Dr. & Daily 1952	15, 16, 20
**	„ f. minor (Wilk.) Dr. & Daily 1952	20
**	thermalis (Menegh.) Dr. & Daily 1952	21
**	„ f. major (Lagerh. ex Forti) Dr. & Daily 1956	6*

ANKISTRODESMUS Corda 1838

**	Braunii (Näg. in Ktz.) Brunnth. in Pasch. 1915	20
*	falcatus (Corda) Ralfs 1848	2, 15
*	„ v. mirabilis (W. & G. S. West) G. S. West 1904	2
**	„ v. spirilliformis G. S. West 1904	20
**	„ v. tumidus (W. & G. S. West) G. S. West 1904	5
**	nannosolene Skuja 1948	20

ANOMOEONEIS Pfitzer in Hanstein 1871

§	brachysira to read (Bréb.) Grun in V.H. 1880—5 and f. thermalis should be v. thermalis	
*	sculpta (Ehr.) Pf. in Hanst. 1871	21
§	serians (Breb.) Cl. 1895 vice A. sculpta in the Addenda	
§	„ v. minor (Grun. in V.H. 1880/1) Boyer 1926/7	12
*	sphaerophora (Ktz.) Pf. in Hanst. 1871	21

APHANOCAPSA Nägeli 1849

**	elachista W. West 1894	
**	„ v. conferta W. & G. S. West 1912	18
**	Grevillei (Berk.) Rabh. 1865	18
*	Naegelii Richt. 1884	18, 19
*	pulchra (Ktz.) Rabh. 1865	18
**	rivularis (Carm. ex Hook.) Rabh. 1865	18

APHANOCHAETE A. Braun 1851 *nom. cons.*

**	hyalothecae (Hansg.) Schmidle 1897	8
**	repens A. Br. 1851	2, 15

APHANOTHECE Nägeli 1849 *nom. cons.*

**	microscopica Näg. 1849	18
*	pallida (Ktz.) Rabh. 1863	15, 18
**	„ v. micrococca Brügg. 1863	18
§	Peniocystis (Kütz.)	16

* saxicola Nag. 1849 18
** „ v. minor Wille 1879 18
** stagnina (Spreng.) A. Br. in Rabh. 1863 16, 18, 20, 21
** „ v. nemathece Frémy 1929 18

ARTHRODESMUS [Ehrenberg] Ralfs 1848

** Heimii Bourr. 1957 15
hirundinella Kr. 1932
** „ f. major Bourr. 1957 15
** mucronulatus Nordst. in Warm. 1870 15
** validus (W. & G. S. West) Scott & Grönbl. 1957 15
(= A. incus v. validus W. & G. S. West 1898)

ASTERIONELLA Hassall 1850

** japonica Cl. in Cl. & Moll. 1882 2, 12, 21.

ASTEROCCOCUS Scherffel 1908

* superbus (Cienk.) Scherff. 1908 5, 15.

ASTEROMPHALUS Ehrenberg 1845

** Arachne (Bréb.) Ralfs in Pritchard 1861 11, 21.
** elegans Grev. 1859 21
*§ flabellatus to read (Bréb.) Grev. 1859 6
** heptactis (Bréb.) Ralfs in Pritchard 1861 21

§ *AULACODISCUS* Ehrenberg 1844

** Johnsonii Arn. ex Pritchard 1861 4, 20.
Kittonii Arnott ex Ralfs in Pritchard 1861
** „ v. africanus (Cottam) Rattray 1888 13

AULISCUS Ehrenberg 1844

** caelatus Bail. 1854 2
** pruinosus Bailey 1854 6
** reticulatus Grev. 1863 2
** rhipis A. S. 1875 2

AULOSIRA [Kirchner 1878] Bornet & Flahault 1888

§ africana Frémy 1930 18 vice A.E.F.

BACILLARIA Gmelin in Linnaeus 1788

§ paradoxa Gmel, in L. The records were listed also under Nitzschia, and can be deleted under this generic heading.

BACTERIASTRUM Shadbolt 1853

*	delicatulum Cl. 1897	21
*	hyalinum Lauder 1864	4, 21

BAMBUSINA [Kützing 1845] Kützing 1849 *nom. cons.*

*	gracilescens (Nordst. in Wittr. & Nordst.) Wolle 1885	15

** *BELLEROCHEA* Van Heurck 1885

**	malleus (Brightw.) V.H. 1885	2, 4, 21

** *BICOECA* (J. Clarke) Stein 1878

**	subsalsa Kuff. 1956.	20

* *BIDDULPHIA* Gray 1831 emend. vice Gray 1882.

*	aurita (Lyngb.) Bréb. & Godey 1838	5, 11, 13
**	„ v. minima Grun. in V.H. 1880/1.	4
*	biddulphiana (J. E. Sm.) Boyer 1901.	4, 11, 13
**	dubia (Brightw.) Cl. 1883	2, 4
**	Edwardsii Febiger ex H. L. Smith 1879	11
*	laevis Ehr. 1843	6, 13, 8, 21
*	longicruris Grev. 1859	2, 4, 5, 21
*	mobiliensis (Bail.) Grun. in V.H. 1880/1	2, 4, 5, 21
*	obtusa (Ktz.) Ralfs in Pritchard 1861	2, 4, 11, 13
**	reticulata Roper 1859	11
§	rostrata Hust. 1939 vice 1950	
**	sinensis Grev. 1866	2, 4
§	Tuomeyi (Bail.) Roper 1859. should be deleted.	
*	tridens Ehr. 1838 vice B. Tuomeyi supra.	4, 6, 21

BLEPHAROCYSTA Ehrenberg 1873

**	splendor-maris (Ehr.) Ehr. 1873.	2, 21

BOTRYOCOCCUS Kützing 1849

*	Braunii Ktz. 1849	5, 15

BREBISSONIA Grunow 1860 *nom. cons.*

Boeckii (Ehr.) Grun. 1860. (The International Code has (Ehr.) O'Meara 1872)

**	„ f. rostrata Schulz 1926	20

BULBOCHAETE [Agardh 1817] Hirn 1900

**	Brebissonii [Ktz. 1854] Hirn 1900	
**	congolenses Gauth.-Lièvre 1954	23
**	horrida Nordst. ex Hirn 1900	15, 23
	intermedia [De Bary 1854] Hirn 1900	
**	„ v. ornata Bourr. 1957	5
**	nigerica Gauth.-Lièvre 1954	15
**	pygmaea [Prings. 1858?] Hirn 1900	15
**	spirogranulata W. & G. S. West 1902	23
**	trochainii Gauth.-Lièvre 1954	23

CALONEIS Cleve 1891

	alpestris (Grun.) Cl. 1894	
**	„ f. minuta Kuff. 1956	21
*	amphisbaena (Bory) Cl. 1894	20
*	brevis (Greg.) Cl. 1894	4
*	fasciata (Lagerst.) Cl. 1984	10, 21
*	formosa (Greg.) Cl. 1894	13, A.E.F.
*	liber (W. Smith) Cleve 1894	13
*	„ v. linearis (Grun.) Cleve 1894	6
*	permagma (Bail.) Cl. 1894	6*
*	silicula (Ehr.) Cleve 1894 v. gibberula (Ktz.) Cleve 1894	13

CALOTHRIX [Agardh 1824] Bornet & Flahault 1886

**	Allorgei Frémy 1945	5, 15
§	atricha Frémy 1930 18 vice A.E.F.	
§	Bossei Frémy 1930 18 vice A.E.F.	
*	breviarticulata W. & G. S. West 1897	18
§	clavata G. S. West 1914 18 vice A.E.F.	
§	cylindrica Frémy 1924 delete A.E.F.	
§	fusca (Ktz.) B. & Fl. 1886	18
§	minima Frémy 1924. delete A.E.F.	
*	parietina [(Näg. ex Ktz.) Thur. 1875] B. & Fl. 1886	15, 18
§	Viguieri Frémy 1930 18 vice A.E.F.	

CAMPTOTHRIX W. & G. S. West 1897

*	repens W. & G. S. West 1897.	20

CAMPYLONEIS Grunow 1862

*§	Grevillei (W. Sm.) Grun. 1867 vice (W. Sm.) Grev. 1867	11

CAMPYLODISCUS Ehrenberg 1840

**	birostratus Deby in A. S. 1875	6
§	clypeus v. dentatus Mills 1932. to be deleted	
§	Daemelianus Grun. in A. S. 1875 vice 1899	
*	echineis Ehr. 1840	2, 4, 8
§*	„ v. dentatus (Mills) Hendey (1957) 1958	6, 13
**	latus Shadbolt 1854	6
*	parvulus W. Sm. 1851 (including C. Thuretii Breb.)	2
*	Ralfsii W. Sm. 1851	6

CAMPYLOSIRA Grunow in Van Heurck 1880/5

*	cymbelliformis (A. S.) Grun. in V.H. 1880/5	6*

CAPSOSIRA [Kützing 1849] Bornet & Flahault 1887

**	Brebissonii [Ktz. 1849] B. & Fl. 1887	5, 18

** *CERATAULINA* H. Peragallo 1892

**	Bergonii H. Perag. 1892.	2, 4, 21
**	compacta Ostenf. & Schmidt.	4? 21

CERATAULUS Ehrenberg 1843

*	Smithii Ralfs in Pritchard 1861	2, 4, 21
*	turgidus Ehr. 1843	2, 4

** *CERATIUM* Schrank 1793

**	arietinum Cl. 1900	21
**	azoricum Cl. 1900	2, 21
**	breve (Ostenf. & Schmidt.) Schröder 1906	21?
**	bucephalum (Cl.) Cl. 1900	2, 21
	buceres Zach. 1906 *sensu* Schill. in Rabh. 1937	
**	„ f. claviger (Kofoid) Schill. in Rabh. 1937	21
**	„ f. inclinatum (Kofoid) Schill. in Rabh. 1937	2, 21
**	„ f. molle (Kofoid) Schill. in Rabh. 1937	2, 4, 21
**	candelabrum (Ehr.) Stein 1883	2, 21
**	„ f. depressum Pouchet 1883	2, 21
**	carriense Gourret 1883	21
**	„ v. volens (Cl.) Jørg. 1911	8, 21
**	contortum (Gourr.) Cl. 1900	4, 21

** euarcuatum Jørg. 1920	21
** extensum (Gourr.) Cl. 1901	2, 4, 21
** „ f. strictum (O. & N.) Nielsen 1934	2, 21
** falcatum (Kofoid) Jørg. 1920	21
** furca (Ehr.) Clap. & Lachm. 1859	2, 4, 8, 21
** fusus (Ehr.) Duj. 1841	2, 4, 21
** gibberum Gourr. 1883	2, 21
** gravidum Gourr. 1883	21
** „ v. angustum Jørg. 1911	21
** hexacanthum Gourr. 1883	2, 21
** horridum Gran. 1902	2, 21
** incisum (Karst.) Jørg. 1911	21
** inflatum (Kofoid) Jørg. 1911	21
** Karstenii Pavill. 1907	21
** Kofoidii Jørg. 1911	2, 21
** lineatum (Ehr.) Cl. 1899	2, 4, 21
** longirostrum Gourr. 1883	21
** longissimum (Schrod.) Kofoid 1907	21
** lumula Schimper in Chun. 1900	2, 8, 21
** macroceros (Ehr.) Cl. 1900	2, 4, 21
** „ v. gallicum (Kofoid) Jørg. 1911	2, 4
** massiliense (Gourr.) Jørg. 1911	2, 4
** minutum Jørg. 1920	21
** paradoxoides Cl. 1900 „West African Coast"	21
** pentagonum Gourr. 1883	2
** „ ssp. robustum (Cl.) Graham & Bronik 1944	21
** „ ssp. tenerum (Jørg.) Graham & Bronik 1944	21
** „ v. subrobustum Jørg. 1920	21
** „ v. turgidum Jørg. 1911	21
** platycorne Daday 1888	21
** praelongum (Lemn.) Kofoid 1907	21
** ranipes Cl. 1900	21
** reflexum Cl. 1900	21
** symetricum Pavill. 1905	2, 8, 21
** teres Kofoid 1907	4
** tricoceros (Ehr.) Kofoid 1908	2, 21
** „ v. contrarium (Gourr.) Schill. in Rabh. 1937	2, 21
** tripos (O.F.M.) Nitzsch 1817	2, 4, 9, 21

** *CERATOCORYS* Stein 1883

** horrida Stein 1883	2, 21
** reticulata Graham 1942	21

** *CEROBODO* Krassilstschick 1886

** agilis (Moroff.) Lemm. 1914	20

CHAETOCEROS Ehrenberg 1844

* affinis Lauder 1864	2, 21
* anastomosans Grun. in V.H. 1881	21
** brevis Schütt 1895	2
* coarctatus Lauder 1864	2, 8, 21
** compressus Lauder 1864	4, 21
** constrictus Gran 1876—8	21 ?
** convolutus Cast. 1886	21
* curvisetus Cl. 1889	4, 21
** debilis Cl. 1894	21
* decipiens Cl. 1873	4, 21
** densus (Cl.) Cl. 1901	2
* didymus Ehr. 1843	2, 21
* Eibenii Grun. in V.H. 1881	4, 21
** gracilis Schütt 1895	21
* hispidum (Ehr.) Brightw. 1856	2 ? 6
* laciniosus Schütt 1891	21
** Lauderi Ralfs in Lauder 1864	2, 21 ?
* Lorenzianus Grun. 1863	2
* peruvianus Brightw. 1856	2, 4, 21
** pseudocurvisetus Mangin 1910	2, 4, 21
* rostratus Lauder 1864	8, 21
* socialis Lauder 1864	8, 21
** subtilis Cl. 1896	4
** teres Cl. 1896	21

** *CHAETONEMOPSIS* Gauthier-Lièvre 1954

** pseudobulbochaete Gauth.-Lièvre 1954	5

** *CHAETOSPHAERIDIUM* Klebahn 1892

** globosum (Nordst.) Klebahn 1893	15

CHAEMAESIPHON A. Braun & Grunow in Rabenhorst 1865

* africanus Schmidle 1901	18
* curvatus Nordst. 1878	18
* incrustans Grun. in Rabh. 1865	18
** subglobosus (Rost.) Lemm. in Pasch. 1925	18

CHLAMYDOMONAS Ehrenberg 1833

** Ehrenbergii Gorosch. 1891 — 6*
** Goroschankinii Chmiel. in Pasch. 1927 — 20

CHLORELLA Beijerinck 1890

hormosphaera Skuja 1949
** „ v. minor Kuff. 1956 — 20

CHROOCOCCUS Nägeli 1849

** cohaerens (Bréb. in Menegh.) Näg. 1849 — 18
** limneticus Lemm. 1898 — 18
** macrococcus (Ktz.) Rabh. 1861 — 18
* minor (Ktz.) Näg. 1849 — 18
* minutus (Ktz.) Näg. 1849 — 18
** turgidus (Ktz.) Näg. 1849 — 2, 18, 20, 21

** *CLIMACODIUM* Grunow 1868

** Frauenfeldianum Grun. 1868 — 2, 8, 21

CLIMACOSPHENIA Ehrenberg 1843

* moniligera Ehr. (1841) 1843 — 11

CLOSTERIUM [Nitzsch 1817] Ralfs 1848

* abruptum W. West 1892 v. brevius W. & G. S. West 1904 — 20
* acerosum [(Schrank) Ehr.] Ralfs 1848 — 5
* acutum (Lyngb.) Bréb. ex Ralfs 1848 — 5
* costatum [Corda 1834] Ralfs 1848 — 2, 14
* Cynthia De Not. 1867 — 2
* Dianae [Ehr.] Ralfs 1848 — 5
* Ehrenbergii [Menegh.] Ralfs 1848 — 5
infractum Messik. 1929
** „ v. rotundatum Grönbl. 1947 — 15
* Leibleinii [Ktz. 1833] Ralfs 1848 — 2
libellula v. intermedium (Roy & Biss.) G. S. West 1914 — 5
§ „ „ „ f. interruptum (W. & G. S. West) *comb. nov. nobis* vice C. libellula v. interruptum W. & G. S. West
* lineatum [Ehr.] Ralfs 1848 — 20
* moniliferum [(Bory)Ehr. 1838] Ralfs 1848 — 19
* nematodes Josh. 1886 — 15
** „ v. proboscoideum Turn. 1893 — 15
* parvulum Näg. 1849 v. angustum W. & G. S. West 1900 — 19

§ Ralfsii Bréb. ex Ralfs 1848 delete 6*
* „ v. hybridum Rabh. 1863 6*
* setaceum [Ehr.] Ralfs 1848 5
* strigosum Bréb. 1856 5
* striolatum [Ehr.] Ralfs. 1848 19
* subulatum (Ktz.)Bréb. 1856 15

§ *COCCOCHLORIS* Sprengel in Linnaeus 1807

This has been placed in the list of names rejected in the International Code; its African representation is re-distributed in the present revision.

** *COCCOMYXA* Schmidle 1901

** minor Skuja 1948 20

COCCONEIS Ehrenberg 1838

§ curvirotunda Temp. & Brun 1889 is identical with C. pellucida which takes precedence as the older name.
** heteroidea Hantzsch in Rabh. 1863 2
** littoralis Subrahmanyan 1946 6, 11, 13
** pelta A. S. 1874 6*
* placentula Ehr. 1838 21
§ „ v. klinoraphis Geit. 1927 vice Geit. in Pasch. 1930
** „ v. lineata (Ehr.) Cl. 1895. f. trilineata (Perag. & Hérib. in Hérib. 1893). A. Cl.-Eul. 1953 20
* scutellum Ehr. 1838 2, 8
** „ v. adjuncta A. S. 1894 12, 20

COELASTRUM Nägeli in Kützing 1849

* cambricum Arch. 1868 5 15
** „ v. intermedium (Bohl.) G. S. West 1907 2, 5, 15, 19
* microporum Näg. in A. Br. 1855 2
** reticulatum (Dang.) Senn 1899 15, 19, (forma)
** sphaericum Näg. 1849 15, 20
** verrucosum (Reinsch) De-Toni 1889 19

COELOSPHAERIUM Nägeli 1849

** dubium Grun. in Rabh. 1865 18
* Kuetzingianum Näg. 1849 18

COLEOCHAETE de Brébisson 1844

**	divergens Prings. 1860	15
**	irregularis Prings. 1860	8, 15
**	nitellarum Jost 1895	8, 23
*	orbicularis Prings. 1860	8, 15
**	pulvinata A. Br. ex Ktz. 1948	15
**	„ v. minor Prings. 1860	8
**	pseudo-soluta Gauth.-Lièvre 1956	15
*	scutata Bréb. 1844	5, 8, 15, 19
**	soluta (Bréb.) Prings. 1860	8, 15

CORETHRON Castracane 1886

**	hystrix Hensen 1887	2, 21

COSCINODISCUS Ehrenberg 1838

	antiquus (Grun.) Rattray 1890	
	„ v. lapponicus A. Cl.-Eul. 1951	
**	„ „ „ f. multispinosus (A. Cl.-Eul.) A. Cl.-Eul. 1951	6*
	„ v. minus A. Cl.-Eul. 1841	
**	„ „ f. bananensis Kuff. 1956	20
*	asteromphalus Ehr. 1844	4
§*	„ v. centralis (Ehr.) Grun. 1884 replaces the entry for C. centralis Ehr. 1838	2, 4, 6, 8, 13, 20, 22
**	„ v. densus A. Cl.-Eul. 1942	20
**	„ v. pabellanica Grun. 1884	4
§	centralis Ehr. 1838 is replaced by C. asteromphalus v. centralis.	
§	circumdatus A. S. 1878 vice 1886	
§	concavus Ehr. 1843 vice Greg. 1857; it is the same as Endictya oceanica q.v.	
*	concinnus W. Sm. 1856	2, 5, 8, 21
**	curvatulus Grun. in A. S. 1878	4, 6*
§*	decipiens (Grun. in Schneider) Grun. in V.H. 1880/1	2, 4, 21
**	decrescens Grun. in A. S. 1878, non Castracane	6*
**	„ v. repletus Grun. 1884	6*
§*	denarius A. S. 1878 vice 1874	2, 4, 6, 8
**	„ v. sinensis Meister 1932	6
**	divisus Grun. in Schneider 1878	4
**	domifactus Hendey (1957) 1958	6
*	excentricus Ehr. 1839	4, 5, 8, 11, 12, 13, 21
**	Granii Gough (1903) 1905	8, 21
**	granulatus Ehr. 1845	6*
**	gravidus (Cl.) A. Cl.-Eul. 1951	2, 4, 21

**	Hustedtii Müller Melchers 1953	6
**	incertus Karsten 1907	4
	It requires a new epithet in view of *C. incertus* Leud.-Fort 1898; we suggest *C. Karstenii nom. nov. nobis.*	
*	Jonesianus (Grev.) Ostenf. 1915	6
**	Kurzii Grun. in A. S. 1888	6
*	kryophilus Grun. 1884	6*
§*	Kuetzingii A. S. 1878 vice 57/17, 18.	6
§	lacustris Grun. in Cl. & Grun. 1880 vice 1881	
§	„ v. septentrionalis Grun. 1884 vice (Grun.) Rattray 1890	
*	lineatus Ehr. 1838	4, 8, 21
**	minor Ehr. 1839	2, 4, 8, 21
§	nitidulus Grun. in A. S. 1878 vice 1886	
*	nitidus Greg. 1857	2, 8
§	nodulifer A. S. 1878 vice 1886	
**	nodulolineatus Hendey (1957) 1958	6
§	obscurus A. S. 1878 vice 1886	
*	oculus-iridis Ehr. 1839	4, 5, 8, 21
§	pacificus (Grun.) Rattray 1890 vice Rattray 1890	
*	perforatus Ehr. 1844	8, 21
**	polychordus Gran 1897.	4
*	radiatus Ehr. 1839	4, 11, 13, 21
**	„ v. parvus Grun. 1878	2, 4, 21
**	rotulus (Meunier) A. Cl.-Eul. 1951	21
	The epithet had already been occupied by GRUNOW, and hence a new one is required when MEUNIER'S taxon is transferred; we suggest *C. pelagicus nom. nov. nobis.*	
**	subtilis Ehr. (1841) 1843	2, 4, 8, 12, 21
**	Vidovichii Müller Melchers 1953	6

COSMARIUM [Corda 1834] Ralfs 1848

*	alatum Kirchn. in Cohn. 1878	5
**	amoenum Bréb. ex Ralfs 1848	15
*	binum Nordst. in Wittr. & Nordst. 1880	5, 19
*	bipunctatum Börgesen 1890	2
*	Blytii Wille 1880	5, 19
	ceratophorum Lütk. 1907	
**	„ v. africanum Bourr. 1957	15
	ceylanicum W. & G. S. West v. sinicum Jao 1949	
*	„ „ f. africanum Bourr. 1957	15
*	circulare Reinsch 1867	19
*	commisurale [Bréb. in Menegh] Ralfs 1848	15
	connatum Bréb. ex Ralfs 1848	
**	„ v. africanum Fr. & Rich 1937	15

** „ v. minor Wolle 1876 15 ?
contractum Kirchn. in Cohn 1878
** „ f. Jacobsenii (Roy a Biss.) W. & G. S. West 1905 15
* decoratum W. & G. S. West 1895 15
* depressum (Näg.) Lund. 1871 20
** dimaziforme (Grönbl.) Scott & Grönbl. 1957 15
** elegantissimum Lund 1871 15
** „ v. subsimplex Grönbl. 1926 15
excavatum Nordst. in Warm. 1870
** „ v. ornatum Bourr. 1957 15
* globosum Bulnh. 1861 20
* granatum Bréb. ex Ralfs 1848 5, 15
Hammeri Reinsch 1867
** „ v. africanum Fritsch 1921 15, 19
* „ v. protuberans W. & G. S. West 1896 5, 15
* heterochondrum Nordst. 1880 15
* impressulum Elfv. 1881 19
** „ f. suborthogonum (Racib.) W. & G. S. West 1908 15
* Lundelii Delp. 1877 v. ellipticum W. West 1894 19
mamillliferum Nordst. in Warm. 1870
** „ v. bituberculatum (Fr. & Rich) Bourr. 1957 15
* margaritatum (Lund.) Roy & Biss. 1886 15
** margaritiferum [(Ehr.) Menegh. 1840] Ralfs 1848 5
medioscrobiculatum W. & G. S. West 1902
** „ v. egranulatum Gutw. 1902 15
* Meneghinii Bréb. ex Ralfs 1848 19
* minimum W. & G. S. West 1895 vice 1897 6*
* moniliforme (Turp.) Ralfs 1848 15
** Monodii Bourr. 1957 15
monomazum Lund. 1871
** „ v. africanum Bourr. 1957 15
multiordinatum W. & G. S. West 1897
** „ v. africanum Bourr. 1957 15
** multituberculatum Fr. & Rich 1937 15
** „ v. africanum Bourr. 1957 15
* norimbergense Reinsch 1867 16
nudum (Turn.) Gutw. 1902
** „ v. minor Bourr. 1957 (replacing W. & T. 1957 *nom. nud.*) 6* 15
* obsoletum (Hantzsch in Rabh.) Reinsch 1867 5, 19
** obtusatum (Gutw.) Schmidle 1898 2
** „ v. undulatum Fr. & Rich 1937 19
onychonema Racib. 1895
** „ f. major Schmidle 1898 15

** ordinatum (Börges.) W. & G. S. West 1896 15
** papekuilense G. S. West 1912 19
* phaseolus [Bréb. in Menegh.] Bréb. ex Ralfs 1848 5
** planum W. & G. S. West 1895 19
** platydesmium (Nordst. & Schmidle in Schmidle 1901 15
** polymorphum Nordst. in Warm. 1870 19
** „ v. africanum Bourr. 1957 15
* pseudobroomei Wolle 1884 5, 15, 20
* pseudoconnatum Nordst. in Warm. 1870 15
* pseudopyramidatum Lund. 1871 15
** „ f. minor Wille 1884 15, 19
** pseudotaxichondrum Nordst. 1877 v. pentachondrum Bourr. 1957 15
* punctulatum Bréb. 1856 21
* quadrum Lund. 1871 5, 19
Regnesi Reinsch 1867
** „ v. montanum Schmidle 1895 15
* repandum Nordst. 1887 20
sexangulare Lund. 1871
** „ f. minimum Nordst. 1887 20
* Stappersii Evens 1949 19
** „ f. triquetra Gauth.-Lièvre 1958 19
Stephensii Rich 1932
** „ v. minor Bourr. 1957 15
* stigmosum (Nordst.) Kr. 1932 19
subauriculatum W. & G. S. West 1895
** „ v. bogoriense (Bern.) Bourr. 1957 15
** subconstrictum Schmidle 1901 16
* subcostatum Nordst. in Nordst. & Wittr. 1876 15, 19
* „ f. minor W. & G. S. West 1896 19
subdistichum Racib. 1892
** „ v. africanum Bourr. 1957 15
subhammeri Rich 1935
** „ v. africanum Bourr. 1957 15
** „ f. major Rich 1935 19
* subspeciosum Nordst. 1875 5, 15
** „ v. validius Nordst. 1887 15
* subtumidum Nordst. in Wittr. & Nordst. 1878 19
** sulcatum Nordst. 1878 v. incrassatum W. & G. S. West 1902 15
** Symoensii van Oye 1959 20
§ taxichondrum Lund. 1871 v. subundulatum Boldt. 188 add f. subdenticulatum W. & G. S. West 1895
* trachydermum W. & G. S. West 1895 5
trachypleurum Lund. 1871 15

** „ v. minus Racib. 1884 5
** zonatum Lund. 1871 15

CRASPEDODISCUS Ehrenberg (1844) 1845

** minutus Kuff. 1956. 20

CRUCIGENIA Morren 1830

* tetrapedia (Kirchn.) W. & G. S. West 1902 5, 15

§ *CYCLOTELLA* (Ktz.) de Brébisson in de Brébisson and Godey 1838 vice Kützing 1834

* Kuetzingiana Thwaites 1848 8, 20
* Meneghiniana Kütz. 1844 20
*§ striata (Ktz.) Grun. in Cl. & Grun. 1880, vice 1881 11
* stylorum Brightwell 1860 11, 13

CYLINDROCYSTIS [Meneghini 1838] De Bary 1858

* Brebissonii [Menegh.] De Bary 1858 20
** „ v. curvata Rab. 1923 f. quadripyrenoidea van Oye 1959 20
* „ v. Jenneri (Ralfs) Hansg. 1888 6
* crassa De Bary 1858 20

CYLINDROSPERMUM [Kützing 1843] Bornet & Flahault 1888

** licheniforme [(Bory) Ktz. 1847] B. & Fl. 1888 18
§* majus [Ktz.] B. & Fl. 1888 f. pachydermaticum (Rabh.) Forti in De Toni 1907 vice v. pachydermaticum Rabh. 1864 18
* muscicola [Ktz.] B. & Fl. 1888 15, 18
§ trichotospermum Frémy 1930 18 vice A.E.F.

** *CYMATODISCUS* Hendey (1957) 1958

** planetophorus (Meister) Hendey (1957) 1958 6

CYMATOPLEURA W. Smith 1851 *nom. cons.*

§* solea (Bréb. in Bréb. & Godey) W. Sm. 1853 vice (Bréb.) W. Sm 1853 21
* „ v. laticeps O. Müll. 1903 A.O.F.

CYMATOSIRA Grunow 1862

** atlantica Freng. 2, 4, 21

** *CYMATOTHECA* Hendey (1957) 1958

** Weissflogii (Grun. in V.H.) Hendey (1957) 1958 6*, 11, 13, 20

CYMBELLA C. A. Agardh 1830

* amphicephala Näg. ex Ktz. 1849 6*
§ cistula (Ehr. in Ehr. & Hempr.) vice Ehr.? in Hempr. & Ehr.)
§ cucumis A. S. 1875 vice 1886
* cuspidata Ktz. 1844 20
§ gracilis (Rabh.) Cl. 1894 is synonymous with C. Rabenhorstii Ross.
§ lanceolata (Ag.) Kirchn. in Cohn 1878 vice (Ehr.) Kirchn. 1878
§ leptoceros (Ehr.) Ktz. 1844 vice (Ehr.) Rabh. 1853
§ Muelleri v. sumatrana Hust. 1949 vice 1937/9.
§ naviculiformis should read Auersw. in Rabh. 1861
* prostrata (Berk.) Brun. 1880 21
* Rabenhorstii Ross in Pol. 1947 12
§ tumida (Bréb. ex Ktz.) V.H. 1880/5 vice (Bréb.) V.H.
* turgida Greg. 1856 21
* ventricosa Ag. 1830 20
§ „ f. minor O. Müll. 1905 vice f. minus (A. Mayer) *comb. nov.*

** *CYMBELLONITZSCHIA* Hustedt in A. Schmidt 1922

** cataractorum Kuff. 1957 20

DACTYLIOSOLEN Castracane 1886

§* mediterraneus (H. Perag.) H. Perag. 1892 vice H. Perag. 1892 21

DACTYLOCOCCOPSIS Hansgirg 1888

* acicularis Lemm. 1900 5
* „ v. grandis Frémy 1930 2
§ africana G. S. West 1907 vice 1907/9
* raphidioides Hansg. 1888 2, 18

§ *DEBARYA* Wittrock 1872 vice (Wittr.) Transeau 1934

** glyptosperma (De Bary) Wittr. 1872 20

DENTICULA Kützing 1844

§ Dusenii Cl. transfer to the genus Fragilariella.

DERMOCARPA Crouan 1858

** Flahaultii Sauv. 1892 — 18
** parva (Conrad) Geitl. in Pasch. 1925 — 18
§ plectonematis Frémy 1930 — 18 vice A.E.F.
** versicolor (Borzi) Geitl. in Pasch. 1925 — 18

DESMIDIUM [Agardh] Ralfs 1848

** Baileyi (Ralfs) Nordst. 1880 f. tetragonum Nordst. 1888 — 15
** longatum Wolle 1884 — 15
** pseudostreptonema W. & G. S. West 1902 — 15

** *DESMONEMA* [Berkeley & Thwaites 1849] Bornet & Flahault 1887

** Wrangelii (Ag.) B. & Fl. 1887 — 18

DIATOMA Grun. 1862 *nom. cons.*

§ elongatum [(Lyngb.) Ag. 1824] Rabh. 1864/8 vice (Lyngb.) Ag.
§ vulgare [Bory de St. Vincent 1828] Grun. 1862 vice Bory 1828
* „ v. Ehrenbergii (Ktz.) Grun. 1862 — 21

DICHOTHRIX [Zanardini 1858] Bornet & Flahault 1886

** Orsiniana (Ktz.) B. & Fl. 1886 — 15
** „ v. africana Frémy 1924 — 19

** *DICTYONEIS* Cleve 1890

** jamaicensis (Grev.) Cleve 1890 — 6
** marginata (Lewis) Cleve 1890 — 6

DICTYOSPHAERIUM Nägeli 1849

* pulchellum Wood 1874 — 2, 15
** reniforme Buln. 1859 — 5

§ *DIMEROGRAMMA* Ralfs in Pritchard 1861. Original spelling was *DIMEREGRAMMA*

§ For D. maximum read D. marinum (Greg.) Ralfs in Pritchard. 1861

DIMORPHOCOCCUS A. Braun 1855

* lunatus A. Br. 1855 — 15

**	*DINOPHYSIS* Ehrenberg 1840	
**	acuminata Clap. & Lachm. 1859	2
**	caudata S. Kent 1881	2, 4, 5, 21
**	diegensis Kofoid 1907	2, 21
**	hastata Stein 1883	21
**	ovum Schütt 1895	2, 21
**	punctata Jorg. 1923	2, 21
**	recurva Kofoid & Skogs. 1928	2, 21
**	sacculus Stein 1883	2, 21
**	tripos Gourr. 1883	2, 21
**	urcantha Stein 1883	2, 21
	DIPLONEIS Ehrenberg 1844	
*	Adonis (Brun.) Cl. 1894 v. oamaruensis Cl. 1894	6
**	advena (A. S.) Cl. 1894	2
*	Bombus (Ehr.) Ehr. 1854	4
**	campylodiscus (Grun. in A. S.) Cl. 1894	11
*	Crabro (Ehr.) Ehr. 1854	2, 11
**	„ v. pandura (Breb.) Cl. 1894	6
*	didyma (Ehr.) Ehr. 1894	13
§*	elliptica (Ktz.) Cl. 1894, 6 vice 6*	16, 21
**	entomon (Ehr.) Cl. 1894	11
*	fusca (Greg.) Cl. 1894	21
§*	gemmatula (Grun. in A. S.) Cl. 1894 vice Grun. 1875	6
*	Gruendleri (A. S.) Cl. 1894	13
*	oblongella (Näg in Ktz.) Cl. 1891	20
*	„ v. ovalis (Hilse in Rabh.) Ross in Pol. 1947	21
**	placida (A. S.) Hust in Rabh. 1937.	2, 5
*	puella (Schum.) Cl. 1894	9
*	Smithii (Bréb. in W. Sm.) Cl. 1894	6, 13
*	splendida (Greg.) Cl. 1894 v. puella (A. S.) Cl. 1894	20
**	suborbicularis (Greg.) Cl. 1894	6
**	suspecta (A. S.) Hendey (1957) 1958	6
**	vetula (A. S.) Cl. 1894	11
*	Weissflogii (A. S.) Cl. 1894.	11
**	*DIPLOPSALIS* Bergh 1881	
**	asymmetrica (Mangin) Souse e Silva 1957	21
**	minor (Pauls.) Sousa e Silva 1955	2, 21
**	orbiculare (Pauls.) Pauls	2
**	*DITYLUM* Bailey 1861	
**	Brightwellii (T. West) Grun. in V. H. 1880/1	2, 4, 6

DOCIDIUM [de Brébisson] Ralfs 1848

*	Baculum [Bréb. in Bréb. & Godey] Bréb. ex Ralfs 1848	15

ENTDICTYA Ehrenberg 1845

*	oceanica Ehr. 1845	4

** *ENTOPHYSALIS* Kützing 1843

**	conferta (Ktz.) Dr. & Daily 1948	6, 11
**	deusta (Menegh.) Dr. & Daily 1948	6, 11, 20
**	lemaniae (Ag.) Dr. & Dailey 1956	6, 21
**	rivularis (Ktz.) Dr. 1943	6, 16, 20

EPITHEMIA de Brébisson 1838

*	cistula (Ehr.) Ralfs in Pritchard 1861	20

EUASTRUM [Ehrenberg] Ralfs 1848

	abruptum Nordst. in Warm. 1870	
**	„ v. subglaziovii Kr. in Rabh. 1937	15
	attenuatum Wolle 1881	
**	„ v. brasiliense Gronbl. 1944	15 (forma)
*	binale [(Turp.) Ehr.] Ralfs 1848 v. curtum (W. & G. S. West) Kr. in Rabh. 1937	21
**	compactum Wolle 1884	15
	crassicolle Lund. 1871	
**	„ v. bicrenatum De-Toni 1889	15
**	cuneatum Jenner ex Ralfs 1848	15
*	denticulatum (Kirchn.) Gay 1884	5, 19
	divergens Josh. 1886	
**	„ v. rhodesiense Rich 1935	15
*	elegans [(Bréb. in Menegh.) Ktz.] Ralfs 1848	5, 19
**	evolutum (Nordst.) W. & G. S. West 1896	15
**	„ v. Glaziovii (Börges.) W. & G. S. West 1898	15
**	„ „ „ f. africanum Bourr. 1957	15
	fissum W. & G. S. West 1902	
**	fissum v. brasiliense Kr. in Rabh. 1937	15, 19
**	Gauthierii Bourr. 1957	15
**	„ f. bifidum Bourr. 1957	15
	Gayanum De-Toni 1889	
**	„ v. angulatum Kr. 1950	15
	longicolle Nordst. 1887	
**	„ f. minor Bourr. 1957	15
	Luetkemuelleri Ducell. 1918	

** Luetkemuelleri v. carniolicum (Lütk.) Kr. in Rabh. 1937 15
* praemorsum (Nordst.) Schmidle 1898 15
sinuosum (Lenorm. ex Ralfs) Archer in Pritchard 1861
** „ v. securiformiceps (Borge) Kr. in Rabh. 1937 15
** sphyroides Nordst. 1887 15
* spinulosum Delp. 1876 15, 19
** „ ssp. africanum Nordst. 1880 v. minus Nordst. 1880 19
* subhexalobum W. & G. S. West 1897 6*
** subhypochondrum Fr. & Rich 1937 15
truncatiforme G. S. West 1907
** „ v. africanum Bourr. 1957 15
** validum W. & G. S. West 1896 15

EUCAMPIA Ehrenberg 1839

* zoodiacus Ehr. 1839 4, 21

** *EUCAPSIS* Clements & Schantz 1909

** alpina Clem. & Schantz 1909 18

EUGLENA Ehrenberg 1830

* acus (O.F.M.) Ehr. 1830 20
* deses (O.F.M.) Ehr. 1833 20
** gracilis Klebs 1883 20
** minima Francé 1893 20
* mutabilis (Klebs) Schmitz 1884 20
** ostendensis Kuff. 1950 20
* oxyuris Schmarda 1846 2, 20
* proxima Dang. 1901 20
** pusilla Playf. 1921 v. longa Playf. 1921 2
** sanguinea (E. & G.) Ehr. 1830 20
** Schmitzii Gojdics 1953 20
* spirogyra Ehr. 1838 20
** splendens Dang. 1901 20
* viridis (Schrank) Ehr. 1830 20

EUNOTIA Ehrenberg 1837

* arcus Ehr. 1838 20
§ biceps Ehr. (1841) 1843 vice Ktz. 1849
* curvata (Ktz.) Lagerst. 1884 10
§* „ v. falcata (Ktz. & Bréb. in Ktz.) W. & T. 1958, delete 2: add 12, 16

* „ „ f. excisa (Grun. in V.H.) W. & T. 1958. 6*, 12
* diodon Ehr. 1837
Eulensteinii Welw. MS ex Comber 1901
** „ f. biconstricta Comber 1901 21
** „ f. constricta Comber 1901 21
§ faba (Ehr.) Grun. in V. H. to be replaced by E. Van Heurckii Patrick 1958
§* flexuosa (Breb. in Ktz.) Ktz. 1849 vice (Breb.) Ktz. 15
* Grunowiana Chol. 1954 6*
§ hexaglyphis Ehr. 1854 vice E. polyglyphis Grun. in V. H. 1881 6*
* major (W. Sm.) Rabh. 1864. 21
§ monodon Ehr. (1841) 1843 vice (Ehr.) Ehr. 1854
* paludosa Grun. 1862 12
* pectinalis (O.F.M.) Rabh. 1864 21
§* „ v. minor (Ktz.) Rabh. 1864 vice (Ktz.) Grun. 1862 21
„ v. undulata (Ralfs) Grun. in Kabh. 1865 15
* „ v. ventralis (Ehr.) Hust. 1911 15
§ sarekensis A. Berg ex A. Cl. Eul. 1953 vice A. Cl. Eul.
§ Van Heurckii Patrick 1958 vice E. faba records.

EUNOTOGRAMMA Weisse 1854

* laeve Grun. in Cl. & Möller 1879 11
§ marinum (W. Sm.) H. Perag. in H. & M. Perag. 1897/1908 replaces Smithiella marina in the Check List, 1958 6*

§ *EUODIA* Bailey ex Pritchard 1861

Several diatomists, e.g. MANN, HUSTEDT and HENDEY, have shown that this generic name cannot stand: HENDEY'S creation of *Cymatotheca* seems preferable to merging the West African material under *Hemidiscus Weissflogii.*
§ Ratabouli Brun. in Leud.-Fort. 1898 see Cymathotheca Weissflogii.

§ *EUPODISCUS* Rattray 1888

The International Code places *Eupodiscus* EHRENBERG 1844 as a rejected name, yielding place to *Aulacodiscus*, *nom. cons.* RATTRAY'S genus is retained, with *E. radiatus* BAILEY 1851 as its type species; as this pre-dates its own genus it requires to be validated, *E. radiatus* [BAIL. 1851] Int. Code 1956.

** *EXUVIELLA* Cienkowsky 1881

** baltica Lohm. 1908 21
** compressa (Bail.) Ost. 1899 2, 21
** cordata Ost. 1901 20

FISCHERELLA (Bornet & Flahault) Gomont 1895

* ambigua (Näg. in Ktz.) Gom. 1985 18, 20
§ Letestui Frémy 1930 18 vice A.E.F.
§ „ f. hapalosiphonoides Frémy 1930 18 vice A.E.F.
** thermalis (Schwabe) Gom. 1895 18
§ Tisserantii Frémy 1930 18 vice A.E.F.

§ *FISCHERELLOPSIS* Fritsch 1932

§ moniliformis (Frémy) Fritsch 1932 and both forms, 18 vice A.E.F.

FRAGILARIA Lyngbye 1819

§* capucina (Bory) Desmaz. 1825 vice Desmaz 1825. 4
leptostauron (Ehr.) Hust. in Rabh. 1931
** „ v. rhomboides (Grun.) Hust in Rabh. 1931 20

** *FRAGILARIELLA* Hendey (1957) 1958

** Dusenii (Cleve) Hendey (1957) 1958 6, 11, 13, 16, 20
[Replaces Denticula Dusenii Cleve]

** *FREMYELLA* De-Toni 1936

** Bessei Frémy 1942 15
** „ v. africana Serp. 1955 15

§ *FRUSTULIA* Grunow in Rabenhorst. 1865 *nom. cons.* non Ag. 1824

All taxa, previously referred to VANHEURCKIA, are now to be regarded here: a complete list is given.

§ amphipleuroides (Grun. in Cl. & Grun.) A. Cl.-Eul. 1934 5
15 vice A.O.F.
§ interposita (Lewis) De-Toni 1891 6*, 13, 16
§ Lewisiana (Grev.) De-Toni 1891 6*, 13, 16, 20
§* rhomboides (Ehr.) De-Toni 1891 5, 6*, 8, 13, 15, 20
§ „ v. elongata Kolk & Kr. 1936 6*
§ „ v. Huberi Meister in Hub.-Pest. 1930 6*
§ „ v. lineolata (Ehr.) Cl. 1894 20
§ rostrata Hust. 1937/9. 6*

§ saxonica [Rabh. 1852] Pfitz. in Hanst. 1871 (= *V. rhomboides*)
„ v. crassinervia (Bréb. ex W. Sm.) V.H. 1881 5, 6*, 8, 9, 14, 16, 20
§ „ v. leptocephala (Östr.) A. Cl.-Eul. 1952 6*
§* „ v. undulata (Hust. in Pasch.) A. Cl.-Eul. 1952 5, 6*, 12
§ styriaca (Grun. in V. H.) Cl. 1894. 20
suspecta (Freng.) *comb. nov. nobis.* (= Vanheurckia suspecta Freng. 1934)
§ „ v. obtusa (Freng.) *comb. nov. nobis.* 6*
§ viridula (Bréb. ex Ktz.) De-Toni 1891 6*, 20
§* vulgaris (Thw.) De-Toni 1891 6*, 8, 9, 12, 20
§ „ v. asymmetrica Cl. 1894 6, 16
§ „ v. minor Zanon 1941 10

** *GLAUCOCYSTIS* Itzigsohn in Rabenhorst 1866

** nostochinearum (Itzigs.) Rahb. 1868 15

GLENODINIUM (Ehrenberg) Stein 1883

** lenticula (Bergh.) Schill. in Rabh. 1937 2, 21
** pygmaeum (Lindem.) Schill. in Rabh. 1937 20

GLOEOACTINIUM G. M. Smith 1926

** matebae Kuff. 1956 20

GLOEOCAPSA Kützing 1843 *nom. cons.*

alpina Näg. ex Cramer in Rabh. 1859
** „ f. ambigua (Näg. in Ktz.) Hollb. in Elenk. 1938 19
** aurata Stiz. In Rabh. 1857 19
* dermachroa Näg. ex Ktz. 1849 18
* gelatinosa Ktz. 1843 20
** lignicola Rabh. 1865 19
§* magma (Bréb. in Bréb. & Godey) Ktz. 1846 replaces some records of Anacystis montana. 18, 19, 20, 23
§ rupestris Ktz. 1846 replaces other records of Anacystis montana, 21
** quaternata (Bréb.) Ktz. 1846 18
** sanguinea (Ag.) Ktz. 1843 15, A.E.F.

GLOEOCYSTIS Nägeli 1849

** planctonica (W. & G. S. West) Lemm. in Pasch. 1915 19

GLOEOTHECE Nägeli 1849

** linearis Näg. 1948 6, 16

GLOEOTRICHIA [J. G. Agardh 1842] Bornet & Flahault 1886

** Juignetii Frémy 1945 5
* natans [(Hedw.) Rabh.] B. & Fl. 1886 15
* Raciborskii Wolosz. 1912
** „ v. Lilianfeldiana (Wolosz.) Geitl. in Pasch. 1925 15

GLYPHODESMIS Greville 1862

§ distans (Greg.) Grun. in V. H. 1880/1 vice Grun. in V. H.

GOMPHONEMA Hustedt in Pascher 1930 *nom. cons.*

It is presumed that all epithets based on C. A. AGARDH 1824 (now excluded as a rejected name) and not included in HUSTEDT'S edition of PASCHER, 1930, require legitimisation in the same way as laid down for Oedogoniales, Desmids and certain groups of Cyanophyta where there are special starting dates. Many non-European taxa will fall into this category. We append our analysis where the name does not appear in PASCHER 1930.

abbreviatum [Leiblein 1830] Hust. in Pasch 1930. vice Ag. 1831.
acuminatum [Ehr. 1836] Hust. in Pasch. 1930.
§ „ v. elongatum [(W. Sm.) V. H. 1881] Mills 1934
§ africanum [G. S. West 1907] Mills 1934
angustatum [(Ktz.) Rabh. 1864] Hust. in Pasch. 1930.
§ „ v. aequale [(Greg.) Grun. in V. H. 1880/1] Mills 1934
§ brachyneura [O. Müll. 1905] Mills 1934
§ Clevei [Fricke in A. S. 1902] Mills 1934
§ Frickei [O. Müll 1905] Mills 1934
* gracile [Ehr. 1838] Hust. in Pasch. 1930 21
§* „ v. dichotomum [(Ktz.) Grun. in V. H. 1880/1] Mills 1934 vice (W. Sm.) V. H. 1880/1
§* gracile v. intricatiforme [A. Mayer 1928] Mills 1934
§ „ v. lanceolatum (Ktz.) Cl. 1894 will require a new name (the argument will be developed else-where, but it suffices to mention that Kützing never claimed authorship as he published G. lanceolatum Ehr.) For such a common diatom we propose G. gracile v. Clevei *nom. nov. nobis.* 15
* „ v. naviculoides [(W. Sm.) Grun. in V. H. 1881]. A. Cleve-Euler 1932 21
§* „ v. turris (Ehr. p. p.) Hust. 1937/9. vice Hust. in Pasch. 1930 12
* intricatum [Ktz. 1844] Hust .in Pasch. 1930

* intricatum v. pumilum [Grun. in V. H. 1880/1] Hust. in Pasch. 1930 21
* ,, v. vibrio [(Ehr.) Cl. 1894] Hust. in Pasch. 1930 21
* lanceolatum [Ehr. 1843] Hust. in Pasch. 1930 8
§ micropus Ktz. 1844 records are transferred to G. parvulum v. micropus
montanum [Schum. 1867] A. Mayer 1931
§* ,, v. commutatum [Grun. in V. H. 1880/1] A. Mayer 1931 21
§ navicella [O. Müll. 1905] Mills 1934
* olivaceum [(Lyngb.) Ktz. 1844] Huts. in Pasch. 1930 21
§ ,, v. tenellum [(Ktz.) Cleve 1894] Mills 1934
§ oxycephalum [Cleve 1894] Mills 1934
§* parvulum [(Ktz.) Ktz. 1849] Hust. in Pasch. 1930, not Ktz. 1849 15, 21
§* ,, v. micropus [(Ktz.) Cl. 1894] Hust. in Pasch. 1930 12, 15, 20
§* ,, v. subellipticum [Cl. 1894] Hust. in Pasch. 1930 8, 12, 15
vice ,,West Africa".
§ subclavatum [(Grun. in Schn.) Grun. in V. H. 1880/1] Freng. 1941 ?
subtile [Ehr. 1843] Hust. in Pasch. 1930
§ ,, v. sagittum [(Schum.) Grun. in V. H. 1880] Hust. in Pasch. 1930 vice (Schum.) Cl. 1894
truncatum [Ehr. 1832] Ross in Pol. 1947
* ,, v. capitatum (Ehr.) W. & T. 1954. f. bipunctatum (Kuff.) *comb. nov. nobis* is required for G. constricta v.capitata f. bipunctata Kuff. 1957 20
§ turris Ehr. 1843. should be deleted completely, owing to the uncertainty whether records belong to G. gracile or G. lanceolatum.

GOMPHOSPHAERIA Kützing 1836

* aponina Ktz. 1836 18

GONATOZYGON De Bary 1856

* monotaenium De Bary in Rabh. 1856 5
** pilosum Wolle 1882 5

** *GONIAULAX* Diesing 1866

** birostris Stein 1883 21
** catenata (Lev.) Kofoid 1911 21

**	diacantha (Meunier) Schill. in Rabh. 1937	2
**	diegensis Kofoid 1911	2
**	digitalis (Pouchet) Kofoid 1911	2, 21
**	Kofoidii Pavill. 1909	21
**	monocantha Pavill. 1916	2, 21
**	pacifica Kofoid 1907	21
**	polygramma Stein 1883	2, 21
**	scripsae Kofoid 1911	2, 21
**	spinifera (Clap. & Lachm.) Diesing 1866	2, 4, 21
**	„ ssp. Estelae Marg. 1953	2, 21
**	Turbynei Murr. & Whitg. 1899	2, 21

** *GONIODOMA* Stein 1883

**	poliedricum (Pouchet) Jörg. 1899	2, 21

** *GOSSLERIELLA* Schütt 1893

**	tropica Schütt 1893	21

GRAMMATOPHORA Ehrenberg 1839

**	macilenta W. Sm. 1856 v. nodulosa Grun. in V. H. 1880/1 f. minima (Grun.) *comb. nov. nobis.*	20
*	oceanica Ehr. 1841	2, 21
*	„ v. communis (Grun.) in V. H.) A. Cl.-Eul. 1953	2
*	serpentina (Ralfs) Ehr. 1844	2
**	undulata Ehr. Ehr. 1840	6, 11

GROENBLADIA Teiling 1952

*	neglecta (Racib.) Teiling 1952	15
**	„ v. major (Taylor) Bourrelly 1957	15

GUINARDIA H. Peragallo 1892

*	flaccida (Castr.) H. Perag. 1892	4, 8, 21

** *GYMNODINIUM* Stein 1883

**	abbreviatum Kofoid & Swz. 1921	21
**	marinum S. Kent 1880/2	21
**	uberrimum (Allm.) Kof. & Swz. 1921	2

** *GYRODINIUM* Kofoid & Swezey 1921

**	calyptoglyphe Lebour 1925	21

GYROSIGMA Hassall 1845 *nom. cons.*

§ attenuatum v. hippocampus (Ehr.) A. Cl.-Eul. vice (W. Sm.) A. Cl.-Eul.
* balticum (Ehr.) Rabh. 1853 2, 4
* distortum (W. Sm.) Griff. & Henf. 1875 6*
§* fasciola (Ehr.) Griff. & Henf. 1875 vice (Ehr.) Cl. 1894 6*, 8
* rectum (Donk.) Cl. 1894 6*

HANTZSCHIA Grunow 1877 *nom. cons.* non Auerswald 1862

* amphioxys (Ehr.) Grun. in Cl. & Grun. 1880 15, 21
* „ v. vivax (Hantzsch in Rabh.) Grun. in Cl. & Grun. 1880 15
** ruziziensis Kuff. 1957 20
** uncinata Kuff. 1957 20
* virgata (Roper) Grun. in Cl. & Grun. 1880 v. leptocephala Östr. 1910 8

HAPALOSIPHON [Nägeli in Kützing 1849] Bornet & Flahault 1887

§ arboreus W. West 1894 18 vice A.E.F.
§ aureus W. & G. S. West 1897 18 vice A.E.F.
** fontinalis (Ag.) Born. 1889 15, 18
** hibernicus W. & G. S. West 1896 18
* intricatus W. West 1894 15, 18
§ luteolus W. & G. S. West 1897 18 vice A.E.F.
* Welwitschii W. & G. S. West 1897 18

HEMIAULUS Ehrenberg 1844

** Hauckii Grun. in V. H. 1880/5 2, 8, 21
** membranaceus Cl. 1873 2, 4, 8, 21
§ polycistinorum Ehr. 1854 vice 1864

HEMIDISCUS Wallich 1860

** cuneiformis Wall. 1860 v. ventricosa (Castr.) Hust. in Rabh. 1930 2, 21

HILDEBRANDTIA Narde 1834

* rivularis (Lieb.) J. Ag. 1851 23

HOMOEOTHRIX (Thuret) Kirchner in Engler - Prantl 1900

** juliana (Menegh.) Kirchn. in Eng.-Prantl 1900 18

**	*HYALOBRYON* Lauterborn 1896	
**	ramosum Lauterb. 1896	15
	HYALODISCUS Ehrenberg 1845	
	laevis Ehr. 1845	6, 11
**	radiatus (O'Meara) Grun. in Cl. & Grun. 1880	8
**	scoticus (Ktz.) Grun. 1879	20?
*	stelliger Bail. 1854	4
	HYALOTHECA [Ehrenberg ex Kützing 1845] Ralfs 1848	
*	dissiliens (J. Sm.) Bréb. ex Ralfs 1848	2, 5
	indica Turn. 1893	
**	„ v. javanica Gutw. 1902	15
*	mucosa [Mert. in Dillw.] Ralfs 1848	5
**	„ v. minor Roy & Biss. 1893	15
**	undulata Nordst. in Wittr. & Nordst. 1879	15
**	„ v. africana Bourr. 1957	15
	HYDROCOLEUM [Kützing 1843] Gomont 1893	
§	Brebissonii [Ktz.] Gom. 1893	18 vice A.E.F.
**	heterotrichum (Ktz.) Gom. 1893	18
	lyngbyaceum [Ktz.] 1849] Gom. 1893	
**	„ v. rupestre [Ktz. 1849] Gom. 1893	18
	HYELLA Bornet & Flahault 1888	
**	fontana Hub. & Jad. 1892	18
	KIRCHNERIELLA Schmidle 1893	
*	lunaris (Kirchn. in Cohn) Moeb. 1894	2
**	microscopica Nyg. 1948	20
*	obesa (W. West) W. & G. S. West 1894	2
	LAGERHEIMIA (De-Toni) Chodat 1895	
**	genevensis Chod. 1895	20
	LAUDERIA Cleve 1873	
**	annulata Castr. 1886	21
*	borealis Gran. 1900	4, 21
	LEPOCINCLIS Perty 1849	
**	ovum f. Fritschiana (Conrad) Conrad 1935	2
**	salina Fritsch 1914	2

LEPTOCHAETE [Borzi 1882] Bornet & Flahault 1886

§ capsosirae Frémy 1930 — 18 vice A.E.F.
§ stagnalis Hansg. 1888 — 18 vice A.E.F.

LEPTOCYLINDRUS Cleve 1889

** danicus Cl. 1889 — 2, 4, 21
** minimus Gran. 1912 — 2, 4, 8, 21

** *LEPTOTHRIX* Kützing 1843

** ochracea Ktz. 1843 — 20

LETESTUINEA Frémy 1930

§ perpusillum Frémy 1930 — 18 vice A.E.F.

** *LEUKOBIUM* Skuja 1948

** micron Skuja 1948 — 20?

LICMOPHORA C. A. Agard 1827 *nom. cons.*

* abbreviata Ag. 1831 — 12
§ communis (Heiberg) Grun. in V. H. 1880/1 vice (Ktz.) Grun. 1867 — 20 vice 2
§* flabellata (Carm. ex Hooker) Ag. 1831 vice (Carm.) Ag. 1831 — 2, 8
§ gracilis (Ehr.) Grun. 1867 vice Grun. 1867
§ ovata (W. Smith) Grun. 1867 vice Grun. 1867

LITHODESMIUM Ehrenberg 1840

** intricatum H. & M. Peragallo 1897/1908 — 2
* undulatum Ehr. 1840 — 2, 4, 6

LYNGBYA [Agardh 1824] Gomont 1893

* aerugineo-coerulea (Ktz.) Gom. 1893 — 5, 18
§ Allorgei Frémy 1930 — 18 vice A.E.F.
** arbustiva Serp. 1955 — 15
§ ceylanica Wille in Rech. 1914 — 15 vice A.E.F.
** „ v. constricta Frémy 1930 — 18
§* Diguetii Gom. in Hariot 1895 — 18 vice A.E.F.; 5
* epiphytica Hieron. in Eng.-Prantl 1898 — 18
§ Hieronymusii Lemm. 1905 — 18 vice A.E.F.
** Juignetii Frémy 1945 — 5

* Lagerheimii [(Möb.) Gom. in Morot 1890] 18
* limnetica Lemm. 1898 18
* Martensiana [Menegh.] Gom. 1893 5, 15
** „ v. major Frémy 1945 5
§ „ f. rupestris Frémy 1930 18 vice A.E.F.
§ mucicola Lemm. 1904 18 vice A.E.F.
§ nyassae Schmidle 1902 A.E.F. ?
* ochracea Thur. 1875 sensu Geit. in Rabh. 1932 18
*§ perelegans Lemm. 1899 5; 18 vice A.E.F.
§ polysiphoniae Frémy 1930 18 vice A.E.F.
* putealis [Mont.] Gom. 1893 15; A.E.F.
§ rubida Frémy 1930 18 vice A.E.F.
** submonilifera Frémy 1945 5

MALLOMONAS Perty 1852

** acaroides Perty 1852 2

MASTOGLOIA Thwaites in W. Smith 1856

** angulata Lewis 1861 6
§ lacustris (Grun. in Schn. 1878) auct. nonnull. vice Grun. 1878
* „ v. amphicephala (Grun. in Cl. & Moll) A. Cl.-Eul. 1953 2
** lemniscata Leud.-Fort. 1879 6
** quinquecostata Grun. 1860 2, 6
* Smithii Thw. ex W. Sm. 1856 6
* splendida (Greg.) Cl. 1895 11

MELOSIRA C. A. Agardh 1824 *nom. cons.*

§ arenaria Moore in Ralfs 1843 vice Moore 1843
§ dendroteres v. epidendron (Ehr.) W. & T. vice (Grun.) W. & T.
distans (Ehr.) Ktz. 1844
§* „ v. africana O. Müll. 1904 vice 1903 5, 9, 12
§ granulata v. angustissima O. Müll. 1899 vice 1905
§ islandica O. Müll. 1906 20
* „ subsp. helvetica O. Müll. 1906 20
* italica (Ehr.) Ktz. 1844 15
* Juergensii Ag. 1824 8
§ lirata (Ehr.) Ktz. 1844 vice 1845
** „ v. seriata (O. Müll.) O. Müll. 1904 20
** Mareei Kuff. 1956 20
* Montagnei (Ktz.) Lagerst. 1876 2, 6*, 11, 13
* nummuloides (Dillw.) Ag. 1824 2, 6*
* varians Ag. 1832 21

MERISMOPEDIA Meyen 1839

§* elegans A. Br. in Ktz. 1849 vice A. Br. 1849 18
* glauca (Ehr.) Ktz. 1845 18
* punctata Meyen 1839 18
* tenuissima Lemm. 1898 18

MESOTAENIUM Nägeli 1849

** chlamydosporum (De Bary) De Bary 1858 20
** De Greyi Turn. 1886 20
** „ v. breve W. West 1892 20
** Endlicherianum Näg. 1849 20
** „ v. grande Nordst. in Wittr. & Nordst. 1879 20
§* macrococcum (Ktz.) Roy & Biss. 1894 vice W. & G. S. West 1896 20

MICRASTERIAS [Agardh 1827] Ralfs 1848

* abrupta W. & G. S. West 1896 15
** alata Wallich 1860 15
* americana (Ehr.) Ralfs 1848 15
* crux-melitensis [(Ehr.) Hass.] Ralfs 1848 15
** „ „ v. tropica Gauth.-Lièvre 1958 19
** decemdentata (Näg.) Arch. in Pritchard 1861 15, 20
* foliacea Bail. ex Ralfs 1848 15
* mahabuleshwarensis Hobson 1863 15
pinnatifida (Ktz.) Ralfs 1848
** „ v. incudiformis W. & G. S. West 1895 15
** radians Turn. 1892 v. brasiliensis (Grönbl.) Kr. in Kr. & Scott 1957 15
** sol (Ehr.) Ktz. 1849 5
** „ v. elegantior G. S. West 1914 15
** tropica Nordst. in Warm. 1869 v. senegalensis Nordst. 1880 2, 15
* truncata (Corda) Bréb. ex Ralfs 1848 5
** „ v. pusilla G. S. West 1914 19

MICROCHAETE [Thuret 1875] Bornet & Flahault 1887

§* investiens Frémy 1930 18 vice A.E.F.; 5
§ violacea Frémy 1930 18 vice A.E.F.

MICROCOLEUS [Desmazières 1823] Gomont 1893

** acutissimus Gard. 1927 15
** chthonoplastes [(Fl. Dan.) Thur. 1875] Gom. 1893 18
** lacustris [(Rabh.) Farl. in Farl. et alia 1877] Gom. 1893. 15, 18

§ minimus Frémy 1930 18 vice A.E.F.
** paludosus (Ktz.) Gom. 1893 18
* sociatus W. & G. S. West 1897 15
§* Tisserantii Frémy 1930 19 vice A.E.F.; 20
* vaginatus [(Vauch.) Gom. in Morot] Gom. 1893. 15, 20, 21
§ violaceus Frémy 1930 18 vice A.E.F.

MICROCYSTIS Kützing 1833

§ elabens (Bréb. in Menegh.) Ktz. 1846 replaces Coccochloris elabens 20

MICROSPORA Thuret 1850 *nom. cons.*

** quadrata Hazen 1902 5

MICROTHAMNION Nägeli ex Kützing 1849

** strictissimum Rabh. 1859 5, 8, 9, 15, 19, 20

MOUGEOTIA C. A. Agardh 1824 *nom. cons.*

** floridana Trans. 1934 15
* parvula Hass. 1843 20
** subcorniculata Gauth-Lièvre 1958 19
** tibestica Gauth.-Lièvre 1958 19
** varians (Wittr. & Nordst.) Cz. in Pasch. 1932 15

** *NANNOCHLORIS* Naumann 1919

** bacillaris Naum. 1919 20

NAVICULA Bory 1824

* abrupta (Greg.) Donkin 1871/2. 6
** aequatorialis Heiden & Kolbe 1928 20
** alpha Cl. 1893 6
* anglica Ralfs in Pritchard 1861 20, „West Africa"
** approximata Grev. 1859 6
** „ „ v. niceaensis (H. & M. Perag.) Hendey (1957) 1958 2, 6
§ atomus (Ktz.) Grun. 1860 vice (Näg.) Grun. 1860
brasiliana (Cl.) Cl. 1894
§ „ v. platensis Freng. 1937. *vide infra* 2, 20
§ „ „ „ f. undulata Guerm. 1954 2
§ brasiliensis v. platensis Freng. 1937 to be transferred as above
§ bryophila Boye-Pet. 1928. vice 1924
§ caduca Hust. 1942 vice 1924

** cancellata Donk. 1871 2
* cincta (Ehr.) Ralfs in Pritchard 1861 21
§ cocconeiformis Greg. in Grev. 1855 vice Greg. 1856
§* confervacea (Ktz.) Grun. in V. H. 1880/1 vice Ktz. 1844 21
§ contenta v. parallela Boye Pet. 1928 vice Boye-Pet. in Pasch. 1930
* crucicula (Sm.) Donk. 1871/2 21
* cryptocephala Ktz. 1844 19
* „ v. veneta (Ktz.) Rabh. 1864 21
* cuspidata (Ktz.) Ktz. 1844 21
* „ v. ambigua (Ehr.) Cl. 1894 21
** Dartevellei Kuff. 1957 20
§* dicephala Ehr. 1838 vice (Ehr.) Ehr. 1838 20, 21
** directa v. incus (A. S.) Cl. 1895 6
** expansa Hagelst. 1939 13
* forcipata Grev. 1859 2, 6
** „ v. densistriata A. S. 1881 11
* gastrum (Ehr.) Ktz. 1844 6*, 20
** „ v. exigua (Greg.) Grun. in Cl. & Grun. 1880 f. lanceolata (O. Müll.) *comb. nov. nobis* is required for N. exigua v. lanceolata O. Müll. 1911 20
§ Grimmei Krasske 1925 vice Krasske in Pascher 1930
§ grossepunctata Hust. 1944 16 vice „West Africa"
** hamulifera Grun. in Cl. & Grun. 1880 11
* Hennedyi W. Sm. 1856 2
** „ v. circumsecta (Grun. in A. S.) Cl. 1895 6
§ „ v. manca A. S. 1874 vice 1885
** „ v. nebulosa (Greg.) Cl. 1895 2, 6, 11
** hyalina Donk. 1861 20
** inaurata Hendey (1957) 1958 6
* lanceolata (Ag.) Ktz. 1844 21
§ longirostris Hust. in Pascher 1930 vice Hust. in Rabh.
** lyroides Hendey (1957) 1958 11
** maculata (Bail.) Edwards 1860 6
** Marlierii Kuff. 1957 20
** membranacea Cl. 1897 4
** monilifera Cl. 1895 6
* mutica Ktz. 1844 v. Goeppertiana (Bleisch in Rabh.) Grun. in Cl. & Grun. 1880 West Africa, fossil
** nummularia Grev. 1859 6
** nyassensis O. Müll. 1910 v. capitata O. Müll. 1910 20
* oblonga (Ktz.) Ktz. 1844 21
* palpebralis Bréb. ex W. Sm. 1853 2, 6
§ pelliculosa (Bréb.) Hilse in Rabh. 1862 vice (Bréb.) Hilse in V. H. 1880/1

** peltoides Hendey (1957) 1958 6
** pennata A. S. 1876 2, 11
** perplexa H. & M. Perag. 1897/1908 2, 6
* Perrotetii (Grun.) Grun. 1877 21
§ platycephala O. Müll. 1910 vice 1905
* praetexta Ehr. 1840 2
§ protracta Grun. in Cl. & Grun. 1880 only
** pseudoapproximata Hendey (1957) 1958 6
* pseudobacillum Grun. in Cl. & Grun. 1880 16
* pupula Ktz. 1844 21
** „ v. mutata (Krasske) Hust. in Pascher 1930 6*
** quadripartita Hust. in A. S. 1936 6*
* radiosa Ktz. 1844 21
§ Reinhardtii v. gracilior Grun. in V. H. 1884. vice 1880/1
Robertsoniana Grev. 1863
** „ v. abnormis (Grun. in A. S.) Amossé 1924 11
* Rotaeana (Rabh.) Grun. in V. H. 1880/1 21
* scopulorum Bréb. ex Ktz. 1849 6
§ simplex Krasske 1925 vice Krasske in Pascher 1930
* spectabilis Greg. 1857 6*, 13
§ spicula (Hickie) Cl. 1894 6* vice 6
** takoradiensis Hendey (1957) 1958 11
** transitans Cl. 1883 6
* tumida Bréb. ex Ktz. 6, 12, 20
* „ v. adriatica (Grun.) Cl. 1894 13
§ tuscula Ehr. 1840 vice (Ehr.) Ktz. 1844
§ vallis-natrii O. Müll 1899 (= N. El Kab) vice (= N. Kabel)
* viridula Ktz. 1833 v. slesvicensis (Grun.) De-Toni 1891 21
§* yarrensis Grun. in A. S. 1876 vice 1893 6, 11

NEIDIUM Pfitzer in Hanstein 1871

* affine (Ehr.) Pfitz. in Hanst. 1871 21
* bisulcatum (Lagerst.) Cl. 1894 15
** dilatatum (Ehr.) Pfitz. in Hanst. 1871 f. intermedium A. Cl.-Eul. 1955 6*
* gracile Hust. 1937/9 f. aequale Hust. 1937/9 6*
§ iridis v. genuinum f. minor (O. Müll.) A. Cl.-Eul. 1955 vice iridis v. minor O. Müll.
* productum (W. Sm.) Pfitzer in Hanst. 1871 20

** *NEONEMA* Pascher 1925

** quadratum Pasch. 1932 6*

NEPHROCYTIUM Nägeli 1849

* lunatum W. West. 1892 — 20

NETRIUM (Nägeli) Itzigsohn & Rothe in Rabenhorst 1856

* digitus (Ehr.) Itzigs. & Rothe in Rabh. 1856 — 19
* „ v. Naegelii (Bréb. ex Pritchard) Kr. in Rabh. 1937 — 15

NITZSCHIA Hassall 1845

**	affinis Grun. 1862	4
*	amphibia Grun. 1862	15, 21
**	angularis W. Sm. 1853	4
**	antillarum (Cl.) Meister 1937	6, 11, 13
**	baculumata Kuff. 1956	20
**	biconiacuta Kuff. 1957	20
*	calida Grun. in Cl. & Grun. 1880	21
**	campechiana Grun. 1880	6
*	circumsuta (Bail.) Grun. in Cl. & Grun. 1880	16
§*	communis Rabh. 1860 vice 1849/50	21
*	congolensis Hust. 1949	6*
§	constricta (Ktz.) Ralfs in Pritchard 1861	6* vice 6
**	corpulenta Hendey (1957) 1958	6
**	curvirectangularis Kuff. 1956	20
§*	dissipata (Ktz.) Rabh. 1860 vice (Ktz.) Grun. 1862	21
*	„ v. acula (Hantzsch in Cl. & Grun.) Grun. in V.H. 1880/1	15
**	distans Greg. 1856/7	6*
**	epithemoides Grun. in Cl. & Grun. 1880	6*
**	fustulata Kuff. 1956	20
§*	granulata Grun. in Cl. & Grun. 1880	11
*	Hantzschiana Rabh. 1860	21
**	hexagonata Kuff. 1956	20
**	„ f. minutissima Kuff. 1956	20
*	hungarica Grun. 1862	21
**	inflata Kuff. 1957	20
**	insignis Greg. 1857	4, 8
**	„ v. Smithii (Ralfs in Pritchard) Pell. 1891	2, 8
**	Jelineckii Grun. 1863	6
§	Kuetzingiana Hilse 1860 vice 1862	
**	Kufferathii *nom. nov. nobis* (see N. rectangulata Kuff.)	20
*	lanceolata W. Sm. 1853	6, 13
*	linearis Ag. teste W. Sm. 1853	15, 21
*	longissima (Bréb. ex Ktz.) Grun. 1862	2, 4, 6, 8, 11, 21
*	„ v. closterium (Ehr.) V. H. 1880/1.	5, 21

** longissima. v. parva V. H. 1880/1 4
* Lorenziana Grun. in Cl. & Grun. 1880 2, 5.
** „ v. incerta Grun. in Cl. & Grun. 1880 5
§ „ v. incurva (Grun. in Schneider) vice (Grun.)
** mammalifera Kuff. 1956 20
** Mareei Kuff. 1956 20
** Martiana (Ag.) Schütt in Engler 1896 11, 13
** microsicula Kuff. 1956 20
** Nelsonii Hanna & Grant 1926 6
§ nicobarica (Grun.) Grun. 1880 vice Grun. in Cl. & Grun. 1880
** obtusa v. lata Hagelst. 1939 6
§ „ v. scapelliformis Grun. in Cl. & Grun. 1880 6* vice 6
** ogivalis Kuff. 1957 20
* palea (Ktz.) W. Sm. 1856 21
* „ v. debilis (Ktz.) Grun. in Cl. & Grun. 1880 21
* paleoides Hust. 1937/9 20
** panduriformis Greg. 1857 4, 11
§ paradoxa (Gmel. in L.) Grun. in Cl. & Grun. 1880 4, 8, 21
§* parvula W. Sm. 1853 delete 5 and 8
perversa Grun. 1880, vice Grun. in Cl. & Grun. 1880 21
** pseudopectinalis Kuff. 1957 20
§* recta Hantzsch in Rabh. 1871 vice 1880 21
** rectangulata Kuff 1957 cannot be sustained in view of the epithet having been occupied by Hustedt in 1952. A new name is thus required, for which we suggest N. Kufferathii *nom. nov. nobis* 20
** reversa W. Sm. 1853 6*
§ senegalensis Grun. 1880 vice Grun. in Cl. & Grun. 1880 2, 21
** seriata Cl. 1883 2, 21
sigma (Ktz.) W. Sm. 1853
§ „ v. Clausii (Hantzsch) Grun. in Schneider 1878 vice Grun. 1868
** „ v. indica Karsten 1907 2, 4
** „ v. rigida (Ktz.) Grun. in Schneider 1878 4, 6
§ „ v. sigmatella Grun. in V. H. 1853 6* vice 6
** spathulata Bréb. ex W. Sm. 1853 4
** spirilliformis Kuff. 1856 20
§ stagnorum Rabh. 1857 vice 1863
§ subacicularis Hust. in A. S. 1922 vice Hust. 1937/9
** subregula Hust. in A. S. 1928 20
§ subtilis (Ktz.) Grun. in Cl. & Grun. 1880 6, 15 vice A.O.F.
** sundaensis Hust. 1937/9 20
* Tryblionella Hantzsch in Rabh. 1860 20
* „ v. victoriae (Grun.) Grun. in Cl. & Grun. 1880 11, 12, 20, 21

** vermicularis (Ktz.) Hantzsch in Rabh. 1859 21
** „ v. flexa (Schum.) A. Cl.-Eul. 1952 6*
** „ v. lamprocampus (?Hantzsch ex Cl. & Grun.) Grun. in V. H. 1880/1 20

** *NOCTILUCA* Suriray ex Lamarck 1816

** miliaris Sur. ex Lam. 1816 2, 4, 5, 21

NODULARIA [Mertens in Juergens 1822] Bornet & Flahault 1888

§ spumigena v. minor should be v. major (Ktz.) B. & Fl. 1888

NOSTOC [Vaucher 1803] Bornet & Flahault 1888

** carneum [(Lyngb.) Ag. 1824] B. & Fl. 1888 18
** ellipsosporum [(Desmaz.) Rabh. 1865] B. & Fl. 1888 18
§ Letestui Frémy 1930 18 vice A.E.F.
** Linckia [(Roth) Born. in Born. & Thur. 1880] B. & Fl. 1888 18
** macrosporum [Menegh. 1843] B. & Fl. 1888 15, 19
§* microscopicum [Carm. ex Harvey in Hook. 1833] B. & Fl. 1888 18
§* muscorum [Ag.] B. & F. 1888 15, 18
** parmelioides [Ktz. 1843] B. & Fl. 1888 18, 20
** punctiforme (Ktz.) Hariot 1891 18
* sphaericum [Vauch.] B. & Fl. 1888 15, 18, 19
* spongiaeforme [Ag.] B. & Fl. 1888 18
** verrucosum [(L.) Vauch. 1803] B. & Fl. 1888 18

NOSTOCHOPSIS [Wood 1869] Bornet & Flahault 1887

* lobatus [Wood] B. & Fl. 1887 18
** Wichmannii van Bosse 1913 18

OEDOGONIUM [Link 1820] Hirn 1900

areolatum [Lagerh. 1890] Hirn 1900
** „ v. africanum Bourr. 1957 15
* crispum [(Hass.) Wittr. 1874] Hirn 1900 v. gracilescens [Wittr. in Nordst. & Wittr.] Hirn 1900 21
** fabulosum Hirn 1900 2
* gracillimum [Wittr. & Lund. in Wittr.] Hirn 1900 21
** Henriquesii de Lacerda 1946/9 15 ?
* mammiferum [Wittr. in Nordst. & Wittr.] Hirn 1900 15 (forma)
** minus [Wittr. 1874] Hirn 1900 15 (forma)
** oblongum [Wittr. 1872] Hirn 1900 19
** porrectum Nordst. & Hirn in Hirn 1900 15

** pratense Trans. 1914 15
** santurcense Tiffany 1936 8
** tapeinosporum [Wittr. 1874] Hirn 1900 f. fowlingense Jao 1937 15

** *OESTRUPIA* Heiden in A. S. 1906

** musca (Greg.) Hust. 1935 6

** *ONCOBYRSA* Agardh 1927

** rivularis (Ktz.) Menegh. 1846 18

** *ONYCHONEMA* Wallich 1860

** laeve Nordst. in Warm. 1870 19
** „ v. macracanthum Grönbl. 1945 15

OOCYSTIS Nägeli in A. Braun 1855

** crassa Wittr. in Wittr. & Nordst. 1880 f. major Printz 1913 15
** elliptica v. africana G. S. West 1912 2, 21
* solitaria Wittr. in Wittr. & Nordst. 1879 19

OPEPHORA Petit 1888

** Martyi Hérib. 1902 6*

OPHIOCYTIUM Nägeli 1849

** capitatum Wolle 1887 19
** „ f. longispinum (Möb.) Lemm. 1899 15
* cochleare (Eichw. 1847) A. Br. 1855 2
* majus Näg. 1849 15

** *ORNITHOCERCUS* Stein 1883

** magnificus Stein 1883 2, 21
** splendens Schütt 1893 21
** Steinii Schütt 1900 2, 8, 21
** Thurnii (Schmidt) Kofoid & Skogs. 1928 2

OSCILLATORIA [Vaucher 1803] Gomont 1893

* Agardhii Gom. 1893 15 ?
* amphibia [Ag.] Gom. 1893 5
** anguina [Bory 1827] Gom. 1893 15
§ breviarticulata Frémy 1930 18 vice A.E.F.
* brevis [Ktz.] Gom. 1893 15, A.E.F.

*	formosa [Bory] Gom. 1893	15
§	Geitleri Frémy 1930	18 vice A.E.F.
§	Hamelii Frémy 1930	18 vice A.E.F.
§	homogenea Frémy 1930	18 vice A.E.F.
**	irrigua [Ktz. 1843] Gom. 1893	18
**	Iwanoffiana (Nyg.) Geitl. 1935	15
**	Lemmermannii Wolosz. 1912	15
*	limnetica Lemm. 1900	18
*	limosa [(Roth) Ag.] Gom. 1893	16, 18
§	Martinii Frémy 1930	18 vice A.E.F.
§	Meslinii Frémy 1930	18 vice A.E.F.
**	ornata [Ktz. 1847] Gom. 1893	18
*	planctonica Wolosz. 1911	5
*	princeps [Vauch.] Gom. 1893	2, 5, 18
**	putrida Schmidle 1901	18
*	sancta [Ktz.] Gom. 1893	18
**	simplicissima Gom. 1893	20
§*	splendida [Grev.] Gom. 1893	delete West Africa, add 5 16, 18
**	subtanganyikae Kuff. 1957	20
*	tenuis [Ag.] Gom. 1893	2, 5, 15

** *OSTREOPSIS* J. Schmidt 1901

**	monotis (Meun.) Lindem. 1928	2, 21

** *OXYTOXUM* Lindemann 1883

**	constrictum (Stein) Bütschli 1885	21
**	elegans Pavill. 1916	21
**	gladiolus Stein 1883	21
**	longiceps Schill. in Rabh. 1937	21
**	sceptrum (Stein) Schröder 1906	21
**	scolopax Stein 1883	21
**	sphaeroideum Stein 1883	21
**	Turbo Kofoid 1907	21

** *PALMOGLOEA* Kützing 1843

**	protuberans (J. E. Sm.) Ktz. 1843	6*, 21

PANDORINA Bory 1824

*§	morum (O. F. M.) Bory 1824	2; A. E. F. can be deleted

PARALIA Heiberg 1863

* sulcata (Ehr.) Cl. 1873 — 2, 4, 5, 11, 21

** *PARAPLECTONEMA* Frémy 1930

** subfuscum Frémy 1930 — 18

PEDIASTRUM Meyen 1829

**	angulosum (Ehr.) Menegh. 1840	15
*	Boryanum (Turp.) Menegh. 1840	5
§	„ v. divergens. Lemm. add 1915	
*	duplex Meyen 1829 v. genuinum A. Br. 1855	5, 15
**	obtusum Lucks. 1907	15
*	simplex (Meyen) Lemm. 1897	19
*	tetras (Ehr.) Ralfs 1844	5, 15
**	„ v. tetraodon (Corda) Rabh. 1868	20

PERIDINIUM Ehrenberg 1832

**	achromaticum Levand. 1902	2, 4
**	africanum tab. remotum Lef. 1932	2
**	breve (Pauls.) Pauls. 1907	2, 21
**	bulla Meun. 1910	2
**	cinctum (O.F.M.) Ehr. 1838 f. Westii (Lemm. in W. & G. S. West) Lef. 1925	15
**	claudicans Pauls. 1907	4, 21
**	conicoides Pauls 1905	2, 4, 5, 21
**	conicum (Gran.) Ostf. & Schmidt 1900	2, 4, 5, 21
**	crassipes Kofoid 1907	2, 21
**	curvipes Ostf. 1906	2, 21
**	depressum Bail. 1855	2, 4, 21
**	diabolus Cl. 1900	2, 21
**	divaricatum Meun. 1919	4
**	divergens Ehr. 1840	2, 21
**	excentricum Pauls. 1907	2
*	gatunense Nyg. in Ost. & Nyg. 1925	2
**	globulus Stein 1883	2, 4, 21
**	„ v. ovatum (Pouch.) Schill. in Rabh. 1937	2, 4, 21
**	„ v. quarnerense Br. Schröder 1900	2, 4, 21
**	grande Kofoid 1907	2, 21. West African Coast
**	Granii Ostf. 1906	2, 21
**	„ f. mite (Pavill.) Schill. in Rabh. 1937	2, 4, 21
**	latispinum Mangin 1926	21
**	leonis Pavill. 1916	2, 4, 21

** longicollum Pavill. 1915 — 21
** longipes Karsten 1907 — 21
** minutum Kofoid 1907 — 2, 21
** nudum Meun. 1919 — 21 ?
** obtusum Karsten 1906 — 21
** oceanicum Vanhöffen 1897 — 2, 21
(Including P. oblongum Cl. 1900)
** orbiculare Pauls. 1907 — 2
** pallidum Ostf. 1899 — 2, 5, 21
** pellucidum (Bergh.) Schütt 1895 — 2, 21
** pentagonioides Balech 1949 — 2, 21
** pentagonum Gran. 1902 — 2, 4, 21
** pyriforme Pauls. 1904 — 2, 21
(Including P. oviforme Dang. 1927)
** rectum Kofoid 1907 — 2, 21
** solidicorne Mangin 1926 — 21
** Steinii Jörg. 1899 — 2, 21
** subinerme Pauls. 1904 — 2, 4, 21
** ,, v. punctulatum (Pauls.) Schill. in Rabh — 2, 4, 21
** Thorianum Pauls. 1905 — 2, 21
** tristylum Stein 1883 — West African Coast, 2, 21
** trochoideum (Stein) Lemm. 1910 — 2, 21

§ *PERONIA* de Brébisson & Arnott ex Kitton 1868
nom. cons. vice de Brébisson & Arnott 1868

§ Heribaudii Brun. & M. Perag. in Hérib. 1893 vice Brun. & Perag.

PETALOMONAS Stein 1859

** klinostoma Skuja 1948 — 2

PETALONEMA [Berkeley 1883] Bornet & Flahault 1887

** involvens (A. Br.) Migula 1907 — 15

PHACUS Dujardin 1841

* longicauda (Ehr.) Duj. 1841 — 5, 15
** onyx Pochm. 1942 — 2
** orbicularis Hüb. 1886 — 2
** platalea Drez. 1921/2 — 15
* pleuronectes (O.F.M.) Duj. 1841 — 5

** *PHALACROMA* Stein 1883

** argus Stein 1883	2, 21
** cuneus Schütt 1895	2, 2
** doryphorum Stein 1883	2, 21
** elongatum Jörg. 1923	21
** ovatum (Clap. & Lachm.) Jörg. 1923	2
** parvulum (Schütt) Jorg. 1923	2, 21
** porodictyum Stein 1883	21
** pulchellum Lebour 1922	21
** rapa Stein 1883	2
** rotundatum (Clap. & Lachm.) Kofoid & Mich. 1911	2
** striatum Kofoid 1907	21

PHORMIDIUM [Kützing 1843] Gomont 1893

** africanum Lemm. 1911	15, 20
§ angustissimum f. major Frémy 1930	18 vice A.E.F.
* autumnale (Ag.) Gom. 1893	15, 16, 18, 21
** californicum Drouet 1942	15
§ cebennense Gom. 1893	18 vice A.E.F.
* Corium [(Ag.) Gom. in Morot] Gom. 1893	15, 18
** favosum (Bory) Gom. 1893	18
* fragile (Menegh.) Gom. 1893	15
* inundatum [Ktz.] Gom. 1893	18
** Jadinianum Gom. in Jad. 1893	15
§ lignicola Frémy 1930	18 vice A.E.F.
** luridum (Ktz.) Gom. 1893	12, 16, 18, 20
** molle (Ktz.) Gom. 1893	18
§ olivascens Frémy 1930	18 vice A.E.F.
§ pachydermaticum Frémy 1930	18 vice A.E.F.
* papyraceum [(Ag.) Gom. in Morot] Gom. 1893	18
* Retzii [(Ag.) Gom. in Morot) Gom. 1893	15, 18
** ,, f. fasciculatum Gom. 1893	18
** ,, f. rupestre (Ktz.) Gom. 1893	18
* subfuscum [(Ag.) Ktz.] Gom. 1893	15, 18
** ,, v. Joannianum (Ktz.) Gom. 1893	18
* tenue (Menegh.) Gom. 1893	15
* tinctorium [Ktz.] Gom. 1893	18
* uncinatum [(Ag.) Gom. in Morot] Gom. 1893	18
* valderianum Gom. 1893	15, 16

PHYMATODOCIS Nordstedt 1877

* irregulare Schmidle 1898	15 (forma)

§ *PINNULARIA* Ehrenberg 1843 *nom. cons.* (not Ehr. 1840)

§ borealis Ehr. 1843 v. scalaris (Ehr.) Cl. 1895 vice (Ehr.) Grun 1860
§ Braunii (Grun. in V.H.) Cl. 1895 v. oboesa Zanon 1941 10 vice 9
* Brebissonii (Ktz.) Rabh. 1864 19
* dactylus Ehr. 1843 21
§ divergens v. Schweinfurthii (A.S.) Cl. 1895 should be deleted
§ „ v. sublinearis Cl. 1895 vice Cl. in A.S. 1876, which was an unnamed figure
§ fasciata (Lagerst.) Hust. in Pascher 1930 transferred to Caloneis
** flamma (A.S.) Cl. 1895 8
§ gibba v. intermedia (Cl.) W. & T. (in the Addenda to the Check List, 1958,) is transferred to P. stauroptera q.v.
* guineensis Zanon 1941 6*
§* legumen Ehr. 1843 vice (Ehr.) Ehr. 1854 21
§ major v. linearis Cl. 1895 vice 1875
§ mesogongyla Ehr. 1843 vice Ehr. 1842
* mesolepta (Ehr.) W. Sm. 1853 13
§ „ v. stauroneiformis (Grun.) Cl. 1895 vice Grun. 1860
* microstauron (Ehr.) Cl. 1891 21
§ nobilis [Ehr. 1840] W. Sm. 1853 vice Ehr. 1840, consequent on the conservation date for the genus
§ stauroptera (Grun.) Rabh. 1864 v. interrupta Cl. 1895 vice P. gibba v. intermedia. 6*, 12
* subcapitata Greg. 1856 21
** sudanensis Zanon 1941 15

PLAGIOGRAMMA Greville 1958

** exiguum Hendey (1957) 1958 13
* staurophorum (Greg.) Heib. 1863 11, 13
** Van Heurckii Grun. in V.H. 1880/1 2, 21

** *PLANKTONIELLA* Schütt. 1893

** sol (Wall.) Schütt 1893 2, 21

PLECTONEMA [Thuret 1875] Gomont 1893

§ Dangeardii Frémy 1930 5, 18 vice A.E.F.
§ Fortii Frémy 1930 18 vice A.E.F.
** nostocorum [Born. in Born. & Thur. 1880] Gom. 1893 5, 18
* Tomasinianum [(Ktz.) Born.] Gom. 1893 18
§ Wollei [Farl.] Gom. 1893 18 vice A.E.F.

§ Wollei f. gracilis Frémy 1930 — 18 vice A.E.F.
** „ f. robusta G. S. West 1907 — 18
§ „ f. robustissima Frémy 1930 — 18 vice A.E.F.

** *PLEUROCAPSA* Thuret in Hauck 1885

** minor Hansg. 1887 — 18

PLEUROSIGMA W. Smith 1852 *nom. cons.*

* aestuarii (Bréb. ex Ktz.) W. Sm. 1853 — 4
§ australe Grun. 1867 vice 1872
** diversistriata Meister 1935 — 6
* formosum W. Sm. 1852 — 20
marinum Donk. 1858
** „ v. italicum (H. Perag.) Cl. 1894 — 4
** Normanii Ralfs in Pritchard 1861 — 4
** „ v. affine (Grun. ex Cl. & Grun.) A. Cl.-Eul. 1952 — 6
* nubecula v. intermedium (W. Sm.) Cl. 1894 — 6, 11, 13
* strigosum W. Sm. 1852 — 6*

PLEUROTAENIUM Nägeli 1849

* caldense Nordst. 1877 — 15
* „ v. cristatum (Turn.) Kr. in Rabh. 1937 — 15
* congolense van Oye 1947 — 6*
* coronatum (Bréb. ex Ralfs) Rabh. 1865 — 5
cylindricum (Turn.) Schmidle 1898
** „ v. Stuhlmannii (Hieron.) Kr. in Rabh. 1937 — 15
Ehrenbergii (Ralfs) De Bary 1858
** „ v. elongatum (W. West) W. West 1892 — 15
* „ v. undulatum Schaarschm. 1883 — 15
** inflatum Kuff. 1932 — 20
* maculatum (Turn.) Kr. in Rabh. 1937 — 15
minutum (Ralfs) Delp. 1877
** „ v. elongatum (W. West) Ced. 1932 — 15
* „ v. gracile (Wille) Kr. 1932 — 15
** trabecula (Ehr.) Näg. 1849 v. elongatum Ced. 1913 — 19
* verrucosum (Bail.) Lund. 1871 — 15

§ *PODOCYSTIS* Bailey ex W. Smith 1856 *nom. cons.* vice Kützing 1844

** adriatica [Ktz. 1844] Ralfs in Pritchard 1861 — 2, 11

PODOLAMPAS Stein 1883

** bipes Stein 1883 — 2, 21

** elegans Schütt 1895 12
** palmipes Stein 1883 2, 21
** spinifer Okamura 1912 21

PODOSIRA Ehrenberg 1840

* terebro Leud.-Fort 1898 6

PORPHYROSIPHON [Kützing 1849] Gomont 1893

* Notarisii [(Menegh. ex Ktz.) Ktz.] Gom. 1893 15, 18

** *PROTONOCTILUCA* Fabre- Domergue 1888/9

** pelagica F. -Dom. 1888/9 21

** *PROROCENTRUM* Ehrenberg 1833

** micans Ehr. 1833 2, 4, 5, 8, 21
** minimum (Pavill.) Schill. in Rabh. 1937 2, 8
** ovale (Gourret) Schill. in Rabh. 1937 4
** rostratum Stein 1883 21
** rotundatum Scill. 1918 2, 21
** scutellum Br. Schröter 1901 2, 4, 8
** triestinum Schill. 1918 2, 21

** *PROTOCERATIUM* Bergh 1882

** reticulatum (Clap. & Lachm.) Bütschli 1885 21

** *PROTOSIPHON* Klebs 1896

** botryoides (Ktz.) Klebs 1896 19

** *PSEUDOEUNOTIA* Grunow 1865

** doliolus (Wall.) Grun. in V.H. 1880/1 21
** ruziziensis Kuff. 1957 20

** *PTYCHODISCUS* Stein 1883

** inflatus Pavill. 1916 21

§ *PYRAMINONAS* should read *PYRAMIDOMONAS*

** *PYROCYSTIS* Murray 1876

** fusiformis (Thomson) Murr. 1885 21
hamulus Cl. 1900
** „ v. inaequalis Shcröder 1906 21
** robusta Kofoid 1907 21

** *PYROPHACUS* Stein 1883

** horologicum Stein 1883 2, 21
** „ v. Steinii Schill. in Rabh. 1937 2, 4, 21

RADAISIA Sauvageau 1895

** Cornuana (Sauv.) Sauv. 1895 18
§ violacea Frémy 1930 18 vice A.E.F.

** *RAPHIDONEMA* Lagerheim 1892

** recta Kuff. 1956 20

RHABDONEMA Kützing 1844 *nom. cons.*

* adriaticum Ktz. 1844 2, 21
§ arcuatum (Lyngb.) Ktz. 1844 is probably correct
§ mirificum W. Sm. 1856 vice 1859

RHAPHONEIS Ehrenberg 1844

* amphiceros (Ehr.) Ehr. 1844 v. rhombica Grun. in V.H. 1881 4
§ belgica (Grun. in V.H.) Wolle 1890 vice Grun. in V.H. 1881
§ nitida (Greg.) Grun. 1868 vice Grun. 1868
** rhomboides Hendey (1957) 1958 6
** superba (Janisch) Grun. 1862 11, 13
* surirella (Ehr.) Grun. in V.H. 1880/5 6

RHIPIDODENDRON Stein 1878

* Huxleyi Kent 1880/2 2, 15

§ *RHIZOSOLENIA* Brightwell 1858 *nom. cons.* vice Ehrenberg 1843

** acuminata (Perag.) Grun. 1905 2, 8, 21
* alata Brightw. 1858 2, 4, 21
** „ f. gracillima (Cl.) Hust. in Rabh. 1929 2, 21
§* „ v. indica (H. Perag.) A. Cl. -Eul. 1951 vice f. indica (H. Perag.) Ostf. 1901 4, 8, 21
** Bergonii Perag. 1892 2, 21
* calcar-avis M. Schulze in Müller 1858 4, 5, 21
§ hebetata [Bailey 1856] Brightw. 1858 is required now the genus is conserved
** „ f. semispina (Hensen) Gran 1905 2, 4, 8, 21
* imbricata Brightw. 1858 4
* „ v. Shrubsolei (Cl.) V.H. 1896 4, 5, 8, 21

*	robusta Norman ex Pritchard 1861	2, 4, 21
*	setigera Brightw. 1858	4, 21
**	Stolterforthii H. Perag. 1888 ,	2, 8, 21
**	styliformis Brightw. 1858 v. latissima Brightw. 1858	2, 21
**	Temperei H. Perag. 1888	21

RHOICOSIGMA Grunow 1867

§ compactum (Grev.) Grun. 1867 vice (Grev.) Perag. 1891

RHOICOSPHENIA Grunow 1860

§ marina (Ktz.) M. Schmidt in A.S. 1899 vice (W. Sm.) M. Schmidt in A.S.

RHOPALODIA O. Müller 1895

*	gibba (Ehr.) O. Müll. 1895	8, 21
*	„ v. ventricosa (Ktz.) V.H. 1896	6*, 21
*	gibberula (Ehr.) O. Müll. 1895	21
**	„ v. musculus (Ktz.) A. Cl.-Eul. 1952	6*
§	hirudiniformis vice hirundiformis	
*	parallela (Grun.) O. Müll. 1895	21

** *ROYA* W. & G. S. West 1896

**	obtusa (Bréb.) W. & G. S. West 1896	20

SCENEDESMUS Meyen 1829

	abundans (Kirchner) Chod. 1913	
**	„ v. brevicauda G. M. Smith 1916	20
*	acuminatus (Lagerh.) Chod. 1902	5
*	acutus (Meyen) Chod. 1926	19
*	arcuatus Lemm. 1899	2
*	„ v. platydiscus G. M. Smith 1916	2
*	armatus (Chod.) G. M. Smith 1916	20
*	bijugus (Turp.) Ktz. 1834	2, 20
*	bijugus v. alternans (Reinsch) Hansg. 1886	5
*	brasiliensis Bohl. 1897	19
	ecornis (Ralfs) Chod. 1926	
**	„ v. polymorphus Chod. 1926	20
	granulatus W. & G. S. West 1897	
**	„ v. verrucosus (Roll) Deduss 1953	2
*	longispinus Chod. 1913	20
*	longus Meyen 1829	20
**	matebae Kuff. 1956	20

**	nanus Chod. 1926	20
*	obliquus (Turp.) Kütz. 1833	2
*	quadricaudus (Turp.) Bréb. in Bréb. & Godey 1835	2, 5
**	„ v. parvus G. M. Smith 1916	20
	rostrato-spinosus Chod. 1926	
**	„ v. serrato-pectinatus Chod. 1926	20

SCHIZOCHLAMYS A. Braun in Kützing 1849

*	gelatinosa A. Br. in Ktz. 1849	5

SCHIZOTHRIX [Kützing 1843] Gomont 1893

**	arenaria (Berk.) Gom. 1893	15 ?
§*	Bioretii Frémy 1924	delete A.E.F.; add 15, 18, 19, A.O.F.
**	„ v. minor Serp. 1955	15
§	cuspidata (W. West) W. & G. S. West 1896	19 vice A.E.F.
*	elongata W. & G. S. West 1897	18
*	Friesii (Ag.) Gom. 1893	15, 18, 20
*	fuscescens [Ktz.] Gom. 1893	15, 18, 19, 20
**	„ f. hyalina Frémy 1930	18, 19
§*	Gomontii van Bosse 1913	18 vice A.E.F.; 20
§	„ v. africana Frémy 1930	18 vice A.E.F.
*	Lamyi [Gom. in Born.] Gom. 1893	18
*	lardacea (Ces. in Rabh.) Gom. 1893	15, 18
§	lutea Frémy 1930	18 vice A.E.F.
*	luteola Duv. & Sym. 1949	15
*	natans W. & G. S. West 1897	18, 19
**	penicillata (Ktz.) Gom. 1893	18
*§	purpurascens (Ktz.) Gom. 1893	15, 19.; delete A.E.F.
**	„ f. cruenta Gom. 1893	18, 19
§	„ v. fasciculata (Frémy) Geit. in Rabh. 1932	delete A.E.F.
§	„ v. pulvinata (Frémy) Geit. in Rabh. 193	delete A.E.F.
**	Richardsii Drouet 1943	15
**	Stricklandii Drouet 1943	15
§	Viguieri Frémy 1930	18 vice A.E.F.

** *SCHROEDERIELLA* Pavillard 1913

**	delicatula (Per.) Pavill. 1913	2, 21

SCHUETTIA De-Toni 1894

*	annulata (Wall.) De-Toni 1894	13

SCOLIOPLEURA Grunow 1860

§ tumida and its variety adriatica are transferred to Navicula q.v.

SCYTONEMA [Agardh 1824] Bornet & Flahault 1887

*	Arcangelii B. & Fl. 1887	18
§	„ f. minus Frémy 1930	18 vice A.E.F.
**	Bewsii F. E. Fritsch 1924	15
*	crispum (Ag.) Born. 1889	18
*§	crustaceum [Ag.] B. & Fl. 1887	23; delete A.E.F.
**	„ v. incrustans (Ktz.) B. & Fl. 1887	19, 23
*	guyanense (Mont.) B. & Fl. 1887	18, 20
**	Hansgirgii Schmidle 1900	20
*§	Hofmannii [Ag.] B. & Fl. 1887	15, 16, 18, 20, 23 delete „West Africa'
§	„ f. phormidioides Frémy 1930	18 vice A.E.F
**	„ v. symplocoides (Reinsch) B. & Fl. 1887	18
*	javanicum [(Ktz.) Born. in Born. & Thur.] B. & Fl. 1887	18
*	Millei [Born. in Born. & Thur.] B. & Fl. 1887	19, 20
**	mirabile (Dillw.) Born 1889	15, 18
**	„ v. Leprieurii (Mont. in Schr. & Maze) Forti in De-Toni 1907	19
§	myochrous [(Dill) Ag.] B. & Fl. 1887 v. chorographicum W. & G. S. West 1897	19 vice A.E.F.
*	ocellatum [Lyngb.] B. & Fl. 1887	15, 18, 19, 20, 21
**	pulchrum Frémy 1924	19
§*	Schmidtii Gom. 1901	18 cive A.E.F.; 20 ?
**	stuposum [(Bréb. ex Ktz.) Born. in Born. & Thur. 1880] B. & Fl. 1887	18, 19
*	tolypotrichoides [Ktz.] B. & Fl. 1887	18

SELENASTRUM Reinsch 1867

*	Bibraianum Reinsch 1867	2
**	capricornutum Printz 1914	20
*	gracile Reinsch 1867	2, 5

SIROCOLEUM [Kützing 1849] Gomont 1893

*	guyanensis [Ktz.] Gom. 1893	2

SIROGONUM Kützing 1843 *nom. cons.*

§*	ventersicum Trans. in Trans et alia 1934 vice Trans. 1934	6*

SKELETONEMA Greville 1865

§* costatum (Grev.) Cl. 1873 vice 1878 — 4

§ *SMITHIELLA* H. Peragallo 1900

The records have been transferred to Eunotogramma marinum

SORASTRUM Kützing 1845

** americanum (Bohl.) Schmidle 1899 — 15

SPHAEROCYSTIS Chodat 1897

* Schroeteri Chod. 1897 — 19

** *SPHAEROTILUS* Kützing 1833

** natans Ktz. 1833 — 20

SPHAEROZOSMA [Corda 1835] Ralfs 1848

* excavatum [Ralfs] Ralfs 1848 — 15
** granulatum Roy & Biss. 1886 — 15

§ *SPIROGYRA* Link in Nees 1820 *nom. cons.* (not Link 1805)

** fluviatilis Hilse 1863 — 20
** „ f. tibestica Gauth.-Lièvre 1958 — 19
** gracilis (Hass.) Ktz. 1849 , — 19
** Grossii Schmidle 1901 — 16
** pseudotexensis Bourr. 1957 — 15
** Quezelii Gauth.-Lièvre 1958 — 19
** Spreeiana Rabh. 1863 — 5
subcylindrospora Jao 1935
** „ v. africana Gauth.-Lièvre 1958 — 19
** Weberi Ktz. 1843 — 20

** *SPIRODISCUS* Jurilj 1949

** spiralis (Ktz.) Jurilj 1949 — 6*

SPIROTAENIA de Brébisson ex Ralfs 1848

* condensata Bréb. ex Ralfs 1848 — 15

§ *SPIRULINA* [Turpin in Levrault 1827] Gomont 1893
vice [Turpin 1829] Gomont 1893

* major [Ktz.] Gom. 1893 — 6*
** subsalsa (Oerst.) Gom. 1893 f. oceanica (Crouan) Gom. 1893 — 18

SPONDYLOSIUM de Brébisson ex Kützing 1849

**	apiculatum Bourr. 1957	15

STAURASTRUM [Meyen] Ralfs 1848

**	affine W. & G. S. West 1905	2
**	aureolatum Playf. 1908	15
	bicoronatum Johnson 1894	
**	„ f. major Bourr. 1957	15
**	bidentulum Grönbl. 1945	15
*	botanense Playf. 1907	15
	brachioprominens Börges. 1890	
**	„ v. africanum Bourr. 1957	15
**	Clevei (Wittr.) Roy. 1893	15 (forma)
**	„ v. africanum Gauth.-Lièvre 1958	19
	connatum (Lund.) Roy & Biss. 1886	
**	„ v. africanum Bourr. 1957	15
	cuspidatum [Bréb. in Menegh. 1840] Arch. in Pritchard 1861	
*	„ v. divergens Nordst. in Warm. 1870	15
	dejectum [Bréb. in Menegh. 1840] Ralfs 1848	
**	„ v. subglabrum Grönbl. 1920 f. major Bourr. 1957	15
*	dilatatum [Ehr. 1838] Ralfs 1848	19
	forficulatum Lund. 1871	
**	„ v. africanum Bourr. 1957	
**	Fuellebornii Schmidle 1902	15
**	galeatum Turn. 1893	15
**	Heimii Bourr. 1957	15
**	„ v. ornatum Bourr. 1957	15
**	hirsutum (Ehr.) Bréb. ex Ralfs 1848	5, 6*
**	inflexum Bréb. 1856	19
	Johnsonii W. & G. S. West 1896	
**	„ v. altior Fr. & Rich 1937	15
**	leptocladum Nordst. in Warm. 1870 v. cornutum Wille 1884	15
**	Libeltii Racib. 1889	15
**	„ f. major Bourr. 1957	15
	longebrachiatum (Borge) Gutw. 1902	
**	„ v. Kriegeri Grönbl. 1945	15
*	longispinum (Bail.) Archer in Pritchard 1861	15 (forma)
**	maamense Arch. 1869	15; A.O.F.
**	Monodii Bourr. 1957	15
	pinnatum Turn. 1893	
**	„ v. subpinnatum (Schmidle) W. & G. S. West 1902	15, 19
*	polymorphum Bréb. ex Ralfs 1848	2, 5

* punctulatum Bréb. ex Ralfs 1848 6*, 19
** „ v. pygmaeum (Bréb. ex Ralfs) W. & G. S. West 1912 5
quadrangulare Bréb. ex Ralfs 1848
** „ v. contectum (Turn.) Grönbl. 1945 15 (forma)
Renardii Reinsch 1867
** „ v. cornifrons Racib. 1889 15
sagittarium Nordst. 1887
** „ f. africanum Bourr. 1957 15
Sebaldii Reinsch 1867
** v. ornatum Nordst. 1873 15 (forma)
** „ „ „ f. minor Bourr. 1957 15
setigerum Cl. 1864
** „ v. subvillosum Grönbl. 1945 15
spiculiferum Borge 1918
** „ v. africanum Bourr. 1957 15
subindentatum W. & G. S. West 1907 v. brasiliense Borge 1918
** „ f. minor Bourr. 1957 15
** subunguiferum Fr. & Rich 1937 15 (forma)
tohopekaligense Wolle 1885
** „ v. trifurcatum W. & G. S. West 1895 15
** trifidum Nordst. in Warm. 1870 15
** triforcipatum W. & G. S. West 1902 15
triundulatum Borge 1899 v. brasiliense Grönbl. 1945
** „ f. simplex Bourr. 1957 15
unguiferum Turn. 1893 v. corniculatum Fr. & Rich 1937
** „ f. africanum Bourr. 1957 15
** Wildemanii Gutw. 1902 v. majus (W. & G. S. West) Scott & Prescott 1956 15

STAUROMATONEMA Frémy 1930

§ viride Frémy 1930 18 vice A.E.F.

STAURONEIS Ehrenberg 1843

§ africana Cleve 1881 vice 1854
* crucicula (Grun. in Cl.) Boyer 1916 21
* parvula Grun. in Cl. & Möller 1878 6*

STENOPTEROBIA de Brébisson ex van Heurck 1896

§ delicatissima (Lewis) V.H. 1896 vice 1899

STEPHANODISCUS Ehrenberg 1845

astraea (Ehr.) Grun. in Cl. & Grun. 1880
* „ v. minutula (Ktz.) Grun. in V.H. 1881 15

STEPHANOPYXIS Ehrenberg 1844

** Palmeriana (Grev.) Grun. 1884 — 2, 8, 21
* turris (Grev. & Arn.) Ralfs in Pritchard 1861 — 21

** *STICTODISCUS* Greville 1861

** trigonus Castr. 1886 — 2

STIGONEMA [Agardh 1824] Bornet & Flahault 1887

* hormoides (Ktz.) B. & Fl. 1887 — 18, 20
** „ v. africanum Fritsch 1923 — 20
§ „ v. tenue W. West 1894 — 18 vice A.E.F.
* informe [Ktz.] B. & Fl. 1887 — 18
§ Lavardei Frémy 1924 — 19 vice A.E.F.
* mamillosum [(Lyngb.) Ag.] B. & Fl. 1887 — 18
* minutum [(Ag.) Hass.] B. & Fl. 1887 — 23
*§ ocellatum [(Dill.) Thur.] B. & Fl. 1887 — 20, delete 19
§ „ f. aquaticum Frémy 1930 (vice 1929) — 18 vice A.E.F.
§ „ f. terrestre Frémy 1930 (vice 1929) — 19 vice A.E.F.
§* panniforme [(Ag.) Kirchn.] B. & Fl. 1887 — 18 vice A.E.F.; 15
* tomentosum (Ktz.) Hieron 1895 — 20
** turfaceum [(Pers.) Cooke 1882/4] B. & Fl 1887 — 18

** *STREPTOTHECA* Shrubsole 1890

** thamensis Shrubsole 1890 — 2, 4, 21

STRIATELLA Agardh 1832

* unipunctata (Lyngb.) Ag. 1832 — 21

STROMBOMONAS Deflandre 1930

§ annulata (Daday) Defl., add 1930
Girardiana (Playf.) Defl. 1930
** „ v. glabra (Playf.) Defl. 1930 — 2

SURIRELLA Turpin 1828

§ All O. Müller's taxa in the Check List (1958) should be dated 1903, vice 1904
§ apiculata W. Sm. should be deleted
** armoricana H. & M. Perag. 1897/1908 — 2, 5
** asperrima Hust. in Hub.-Pest. 1942 — 6*
* bifrons (Ehr.) Ehr. 1841 — 8, 21
* „ f. minor O. Müll. 1903 — 6*

§ constricta Ehr. and its variety africana O. Müll. should be deleted
* fastuosa Ehr. 1840/1 11
** „ v. cuneata (A.S.) H. & M. Perag. 1897/1908 6
** „ v. spinulifera A.S. 1875 6
§* gemma (Ehr.) Ktz. 1844 vice Ehr. 1839 2, 6*
** Guinardii H. Perag. 1888 2
hybrida Grun. in V.H. 1880/1
** „ v. contracta H. & M. Perag. 1904 2
* linearis W. Sm. 1853 v. constricta (Ehr.) Grun. 1862 20
** Muelleri Hust. in A.S. 1922 non Forti 20
§ obtusiuscula G. S. West 1907 vice W. West 1906
§ ovalis Bréb. in Bréb. & Godey 1838 vice Bréb. 1838
** „ v. apiculata (W. Sm.) Mills & Philip 1901 9, 21
** „ v. salina (W. Sm.) A. Cl.-Eul. 1952 6*
* ovata Ktz. 1844 v. angusta (Ktz.) A. Cl.-Eul. 1952 21
§ „ v. minuta (Bréb. ex Ktz.) H. & M. Perag. 1879/1908 vice (Bréb.) A. Cl.-Eul. 1952.
§ „ v. pinnata f. panduriformis (W. Sm.) A. Cl.-Eul. 1952 vice 1932
* recedens A.S. 1875 11, 13
* robusta Ehr. 1840 8
* „ v. splendida (Ehr.) V.H. 1880/1 21
** senta Hendey (1957) 1958 6
* Smithii Ralfs in Pritchard 1861 2
* tenera Greg. 1856 6*, 21
§ „ v. nervosa A.S. 1875 vice 1885

SYMPLOCA [Kützing 1843] Gomont 1893

** cartilaginea (Mont.) Gom. 1893 20
§ elegans [(Menegh.) Ktz.] Gom. 1893 19 vice A.E.F.
* muralis [Ktz.] Gom. 1893 18
* muscorum [(Ag.) Gom. in Morot] Gom. 1893 18, 19, 20
* „ v. fusca Frémy 1924 20
§ parietina (A. Br. in Rabh.) Gom. 1893 18 vice A.E.F.

SYNECHOCOCCUS Nägeli 1849

§ aeruginosus Näg. 1849 is necessary as *Coccochloris* is now rejected

SYNEDRA Ehrenberg 1830

§* acus Ktz. 1844 v. delicatissima (W. Sm.) Grun. in V.H. 1896 21
** baculus Greg. 1857 11
** bananensis Kuff. 1956 20
** berolinensis Lemm. 1900 20

* fulgens (Grev.) W. Sm. 1853 11
** superba Ktz. 1844 11
* tabulata (Ag.) Ktz. 1844 21
§ ,, v. fasciculata (Ag.) H. & M. Perag. 1897/1908 vice (Ktz.) H. & M. Perag. 1897/8.
ulna (Nitzsch) Ehr. 1838
* ,, v. danica (Ktz.) Grun. in V.H. 1881 f. continua A. Cl.-Eul. 1932 9
* ,, v. oxyrhynchus (Ktz.) V.H. 1885 20
§ ,, v. vitrea (Bory ex Lenorm. *teste* Ktz.) Grun. in V.H. 1881 vice (Bory) Grun. in V.H. 1881
* undulata Bailey 1853 6

SYNURA Ehrenberg 1838

* uvella Ehr. 1838 2

TABELLARIA Ehrenberg 1839

* flocculosa (Roth) Ktz. 1844 21

TERPSINOE Ehrenberg 1841

§* americana (Bail.) Ralfs in Pritchard 1861 vice 1859 8, 13
* Brebissonii (Ktz.) V.H. 1896 4
* musica Ehr. (1841) 1843 8
* ,, v. intermedia (Grun.) Hust. in Rabh. 1930 8

** *TETRADINIUM* Klebs 1912

** intermedium Geitl. 1928 15

TETRAEDRON Kützing 1845

* minimum (A. Br. in Rabh.) Hansg. 1888 2, 15
* regulare Ktz. 1845 v. bifurcatum Wille 1884 5
* ,, f. minus Reinsch 1888 19
** ,, v. pachydermum Reinsch f. minor Reinsch 1888 2
** tetragonum (Nag.) Hansg. 1889 2

** *TETRASTRUM* R. Chodat 1895

** staurogeniaeforme (Schroeder) Lemm. *fide* Chod. 1902 20

THALASSIOTHRIX Cleve & Grunow 1880

* Frauenfeldii (Grun.) Grun. in Cl. & Grun. 1880 4, 21
** javanica (Grun. in V.H.) Hust. in Meister 1932 6

* longissima Cl. & Grun. 1880 — 6
§* nitzschioides (Grun.) Grun. in V.H. 1880/1 — 2, 4, 11, 21

TOLYPOTHRIX [Kützing 1843] Bornet & Flahault 1887

§ arboricola Frémy 1930 — 18 vice A.E.F.
* byssoidea (Berk.) Kirchn. in Eng.-Prantl 1900 — 15, 18, 19
f. lignicola (B. & Fl.) Frémy 1930 has been designated as the type.
§ Letestui Frémy 1930 — 18 vice A.E.F.
§ pulvinata (Frémy) Geitl. in Rabh. 1932 — 18 vice A.E.F.
** Roberti-Lamii Bourr. in Bourr. & Mang. 1952 — 15
* tenuis [Ktz.] B. & Fl. 1887 — 5, 18

TRACHELOMONAS Ehrenberg 1833

* abrupta Swir. 1914 — 19
* „ v. minor Defl. 1926 — 19
* africana Fritsch 1914 — 20
** „ v. pulchella Bourr. in Bourr. & Mang. 1952 — 6*
§* armata (Ehr.) Stein 1878 vice 1883 — 15
§ cervicula Stokes is a variety of Tr. volvocina.
* euchlora (Ehr.) Lemm. 1905 — 20
** hexangulata (Swir.) Playf. 1915 — 2
* „ f. lata Defl. 1926 — 2
* hispida (Perty) Stein 1878 — 2, 20
§ „ v. crenulatocollis (Mask.) Lemm. add 1910
megalacantha da Cunha 1914
** „ v. ornata Bourr. 1957 — 15
§ oblonga Lemm. add 1910
** ovalis von Daday 1905 — 20
** piscatoris (Fischer) Stokes 1886 — 20
** teres Mask. 1886/7 — 20
** varians Defl. 1926 — 2
* volvocina Ehr. 1833
§ „ v. cervicula (Stokes) Playf. 1915 vice T. cervicula
§ Volzii Lemm. add 1905

TRACHYHEIS Cleve 1894

§ antillarum (Cl.) Cl. 1894 vice 1896
* aspera (Ehr.) Cl. 1894 — 4, 11, 13
** „ v. intermedia (Grun.) in A.S. Cl. 1894 — 2, 11
** „ v. vulgaris Cl. 1894 — 2, 4, 8
** clepsydra (Donk.) Cl. 1894 — 6
** formosa Meister 1932 — 6

** *TRAPEZODESMUS* Kufferath 1932

** Vanderysti Kuff. 1932 26

TRIBONEMA Derbès & Solier 1856

* bombycina (L.) Derb. & Sol. 1856 16

TRICERATIUM Ehrenberg 1841

* alternans Bail. 1851 4, 11, 26
§* antediluvianum (Ehr.) Grun. in Fenzl 1870 vice (Ehr.) Grun. 1876 2, 22, 21
* contortum Shadb. 1854 4
§ cruciferum A.S. is not listed in Mills „Index"; perhaps T. cruciforme A.S. was intended.
* dubium Brightwell 1859 11
* favus Ehr. 1839 2, 4, 11, 21
* „ f. quadratum Grun. in A.S. 1885 2
** grande Brightwell 1853 2
§ parallelum Ehr. *fide* Grev. 1865 vice Grev. 1865
* pentacrinus Wallr. 1858 2
§ reticulum Ehr. 1843 records should be transferred to T. sculptum
* scitulum Brightwell 1853
** sculptum Shadb. 1854 6*, 8
** Shadboltianum Grev. 1862 21

TRIPLOCERAS Bailey 1851

** gracile Bail. 1851 v. bidentatum (Nordst.) Kr. in Rabh. 1937 15

** *TRIPOSOLENIA* Kofoid 1906

** depressa Kofoid 1906 21
** intermedia Kofoid & Skogs. 1928 21
** truncata Kofoid 1906 21

TROPIDONEIS Cleve 1891

** antarctica (Grun. in Cl. & Möller) Cl. 1894 4
* lepidoptera (Greg.) Cl. 1894 2, 4, 21
§ pusilla and recta should both read (Greg.) Cleve 1894, not 1896

** *TRYBLIOPTYCHUS* Hendey (1957) 1958

** cocconeiformis (Cleve) Hendey (1957) 1958 6, 13

ULOTHRIX Kützing 1833

* zonata (Web. & Mohr.) Ktz. 1833 18

§ *VANHEURCKIA* de Brébisson is replaced by FRUSTULIA *nom. cons.* q.v.

** *VOLVOX* Linnaeus 1758

** globator L. 758 19

XANTHIDIUM [Ehrenberg 1833] Ralfs 1848

** antilopaeum (Bréb. in Menegh.) Ktz. 1849 v. basiornatum Eichl. & Racib. 1893 15
** calcarato-aculeatum (Hieron.) Schmidle 1898 15 (forma)
** concinnum Arch 1883 15 (forma)
* cristatum Bréb. ex Ralfs 1848 15 (forma)
pseudobengalicum Gronbl. 1921
** „ v. basiornatum Bourr. 1957 15
sansibarense (Hieron.) Schmidle 1898
** „ f. simplex Bourr. 1957 15

XENOCOCCUS Thuret in Bornet-Thuret 1880

* rivularis (Hansg.) Geitl. 1925 18

§ *ZYGNEMA* C. A. Agardh 1817 *nom. cons.* vice C. A. Agardh 1824

§ adpectinatum Trans. in Trans. et alia 1934 vice Trans. 1934

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PROF. DR. R. MAUCHA.

Prof. Dr. R. Maucha 75 Jahr

Professor Dr. RUDOLF MAUCHA, Ordentliches Mitglied der Ungarischen Akademie der Wissenschaften, 20 Jahre hindurch Direktor der aufgelösten Landesanstalt für Fischbiologie und Abwasserkunde, hat am 19. September 1959 sein 75. Lebensjahr erreicht.

Die wissenschaftliche Lebensbahn Professor MAUCHA's war aufs engste mit den hydrobiologischen und wasserchemischen Forschungen verbunden. Er war einer der ersten Begründer und erfolgreicher Bahnbrecher der Produktionsbiologie als eines selbständigen Wissenschaftszweiges.

Er war Schüler und engster Mitarbeiter von Professor Ludwig WINKLER, dessen Methode der Sauerstoffbestimmung sowie sonstige wasserchemische Untersuchungen zu Weltruf gelangten.

Die ersten Arbeiten Professor MAUCHA's befassten sich mit den chemischen Verhältnissen des adriatischen Meeres und mit der Frage der Wirkungen der Abwässer.

Wir wollen hier einige Tatsachen aus dem Lebenswerk Professor MAUCHA's anführen. Damit wollen wir die Aufmerksamkeit auf jene Erfolge hinlenken, welche die hydrobiologische Forschung bedeutend vorwärtsgebracht haben.

Bereits in seinem ersten, in ungarischer Sprache (1923) erschienenen Werk hydrobiologischen Inhaltes weist er auf die grundlegenden Fragen der Produktionsbiologie, auf die chemischen Grundlagen der Produktion, auf die Rolle von Licht und Wärme u.s.w. hin. Auf dem Internationalen Limnologischen Kongress in Innsbruck (1924/a) stellte er fest, dass . . . „the photosynthetic production of the nannoplancton follows the rules of the kinetics of the macroheterogeneous systems and therefore its surface is limited by the carbon dioxide contents of water „(p. 398) . . ." because the individuums can only multiply till their common surface attains a value adequate to the carbon dioxide concentration „(p. 383) . . ." also enabled to utilise the half bound carbon dioxide" (p. 387).

Im Zusammenhange mit dem in den See eindringenden Lichte stellt er fest: . . . "It is conspicuous that there is a certain intensity of light on which and whence forth the value of the constant becomes nil just as in dark. The optimal intensity of light has a value much under that of the direct radiation of the sun" (p. 389). Damit erklärt er auch die in den Fischteichen zur Sommerzeit beobachteten

Fischverluste, indem nämlich ... "life in the sea becomes gradually more abundant towards the polar regions" (p. 392) ... "both regional and depth distribution of the nannoplankton depends under similar circumstances in the first place upon the intensity of light" (p. 394). In seinen Werken aus den Jahren 1924b; 1927; 1937; 1942a und 1943 befasst er sich mit den Fragen der Lichtintensität.

Gründlich studiert er die Quellen des assimilativen Kohlenbedarfes des Phytoplanktons ... "The carbon dioxide being in both forms free gas and half bound carbon dioxide of the hydrocarbonates in conclusion of our investigations the principle nourishment of the producers, we might prefer to put it at the top of the list of nourishing matters" (1924b, p. 413). Diese Feststellung führte dann im Jahre 1952 zur Methode der Karbondüngung der Fischteiche.

Mit seinen weiteren Untersuchungen beweist er auch (1927), dass ... „das Phytonannoplankton neben der freien auch die halbgebundene Kohlensäure und sogar die Kohlenstoffvorräte der gelösten Karbonate auszunützen befähigt ist" (p. 10).

Zu gewissen Zeiten wurde – nach NAUMANN, – als Grundlage der Produktivität der Gewässer ihr Kalkgehalt angesehen. Professor MAUCHA stellte fest, dass ... „als Vorbedingung der Produktivität der Seen kann demnach an Stelle des Kalkgehaltes vielmehr die Menge der halbgebundenen Kohlensäure bezeichnet werden." (1943; p. 315).

Professor MAUCHA gruppiert auch die Gewässer nach ihrem ausnutzbaren CO_2-Gehalt (1947; 1949). Die bekannte Methode der Darstellung seines Sterndiagrammes modifizierte er in der Weise, dass dieses durch seine Grösse den gesamten Salzgehalt bzw., wenn man den Radius der 16 Winkel im Verhältnis zum ausnutzbaren Kohlendioxid berechnet, auch zur Darstellung der Produktivität geeignet ist (1947; 1949).

Weiters fand er auch einen quantitativen Zusammenhang zwischen der, durch das pH ausgedrückten aktuellen Reaktion des Gewässers und der Assimilationstätigkeit des Phytoplanktons (1929).

Sehr eingehend befasste er sich mit der Frage der Produktionsfähigkeit der Gewässer (1924a p. 400). Ihm ist ferner auch die Einführung der in der Limnologie allgemein verwendeten Methode der Messung der Assimilation von beleuchteten und verdunkelten Flaschen zu verdanken (1923). Von ihm stammt auch die Festlegung und Umschreibung der Begriffe einer totalen, aktuellen und potentiellen Produktion (1952a 1953).

In einem seiner grossangelegten Werke (1942) behandelt er eingehend die Frage des Gleichgewichtes des limnischen Lebensraumes (1942 a, 1942b) wie folgt: ... „Die Analogie zum Lebensraum lässt sich in dieser Hinsicht auch verfolgen, da eine ganze Reihe pendeln-

der Gleichgewichtszustände im limnischen Lebensraum nachgewiesen werden kann, die durch Vermittlung der periodischen Schwankungen des Sonnenlichtes und der Wassertemperatur in kausalem Zusammenhange mit dem Rhythmus des Sonnensystems stehen." (1943, p. 311). Dieser Gedanke bringt uns die grossen Zusammenhänge des Weltalls näher, welchen Gedanken er in seinem Werke „Die Photosynthese des Phytoplanktons vom Gesichtspunkte der Quantenlehre" (1948) ausführte.

Bei seiner Beschäftigung mit der Produktionsbiologie interessierte ihn eingehend die Rolle, welche den einzelnen Gruppen der Lebewesen im Ökosystem des Wassers zukommt. Als wichtigste Produzenten betrachtet er vor allem die Algen (1924) und weist er auch auf die nützliche Tätigkeit der Bakterien hin ... "We might call this mutualism between bacteria and algae a kind of symbiosis." (1924b, p. 405). Seiner Ansicht nach geben die in der Fachliteratur bekannten Benennungen der Organismengruppen, wie Produzenten, Konsumenten nicht genügend anschaulich die Rolle wieder, welche diese im Wasser spielen; er beantragt deshalb die Einführung der Benennung dieser als konstruktive, akkumulative und dekomponierende Organismen (1952).

In einem seiner Werke führt er aus, dass ... „wir uns ein richtiges Bild über die ökologischen Verhältnisse nur dann machen können, wenn der Chemismus des Wassers vollständig bekannt ist." (1943, p. 326). Dies hält er bei Abfassung seines Buches „Hydrochemische Methoden in der Limnologie" (1932) sowie bei der Bearbeitung seiner „Hydrochemischen Halbmikro-Feldmethoden" (1945).

In den letzten Jahren erschienen von ihm – leider bloss in ungarischer Sprache, – viele synthetische Abhandlungen über die Produktion der Gewässer und ihre mit der Fischzucht verbundenen Zusammenhänge.

Indem wir hier diesen enggefassten Überblick über die wissenschaftliche Tätigkeit Professor Rudolf Maucha's gelegentlich seines 75. Lebensjahres bringen, wollen wir ihm aus vollem und aufrichtigem Herzen beste Gesundheit und weitere Arbeitserfolge wünschen.

Dr. E. Woynárovich

Wichtigste Werke von Rudolf Maucha

1910. Daten über die Verlässlichkeit der zur Bestimmung des im Wasser gelösten Sauerstoffes dienenden Methoden. Z. f. Fischerei I. Neue Folge. 46—54.

1912. Szennyvizek és azok hatása a halakra. Ammonóiumszódagyári szennyvizek. Dr. Unger Emil-lel. Kisérl. Közl. XV. 509—532. Bp. Abwässer

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Louis Suball, Die Neuentdeckung der Erde. Verlag Georg Fromme & Co, Wien und München. For Holland: J. J. Kuurstra, Amstelkade 113, Amsterdam. 288 pp. 70 ill.

On various occasions speaking about the geographical distribution of Protists, I drew the attention to the fact that protozoologists who want to understand the geographical distribution of lower animals and plants are handicapped by the lack of geological maps.

In the book of Suball the author exposes a new theory. It is not the place here to discuss this matter, but what is of outstanding value to the biogeographer, is that the book is accompanied by 2 maps illustrating the different positions of the poles in the various geological periods.

It is a new viewpoint with fruitful possibilities which geologues should keep in mind if they want their work to be of importance for biogeographical studies.

Once the new conceptions will have been compared to the older views, the result will be of positive value to biogeography.

In the meantime the maps of Suball will be very useful for the study of biogeography of the lower organisms.

P. v. O.

M. Voigt: Die Tierwelt Mitteleuropas: Gastrotricha.
1. Band Lief. 4a
Verlag von Quelle & Meyer, Leipzig
74 pp. 7 DM

Dr. Voigt who gave us his beautiful work on Rotatoria (Hydrobiologia, vol. XII, 242), has also worked out the Gastrotricha, yet only of Central Europe.

In spite of this limitation he quite often mentions species from outside this area. Consequently this work is also useful for those workers making studies in other countries.

The name of Voigt guarantees the thoroughness of the book. Most species are represented in the text (23 figg.) and on 12 separate plates with numerous drawings.

P. v. O.

CONTENTS

A. P. Austin: Observations on the Growth, Fruiting and Longevity of *Furcellaria fastigiata* (L.) Lam. *(Marine Biology Station, Menai Bridge)* ... 193

N. N. Smirnov: Nutrition of *Galerucella nymphaeae* L. (Chrysomelidae), Mass Consumer of Water-Lily. *(Lab. of Zooplankton and Zoobenthos, Institute of Reservoir Biology Borok, Nekouz, Jaroslavl)* ... 208

N. Woodhead & R. D. Tweed: A Second Check-List of Tropical West African Algae. *(Dept. of Botany. University College of North Wales, Bangor)* ... 225

Personalia: Professor Dr. R. Maucha 75 Jahre ... 287

Bibliography ... 292

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